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THE DEVELOPMENT AND TESTING OF AN EMBOSSED NOTATION SYSTEM AS A METHOD OF TEACHING MOTOR SKILLS TO BLIND CHILDREN

DISSERTATION

Presented in Partial Fulfillment of the Requirements for
the Degree Doctor of Philosophy in the Graduate
School of The Ohio State University

by

Jane Henrietta Heidorn, B.S., M.A.

****

The Ohio State University

1968

Approved by

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DEDICATION

To my parents, Karen E. Heidorn and August F. Heidorn

with love and appreciation

ACKNOWLEDGMENTS

The writer wishes to express her sincere gratitude to her adviser, Dr. Margaret Mordy. She has been an ideal adviser, and without her encouragement and support this dissertation would have been impossible. She also wishes to thank the members of her reading committee, Dr. Bruce Bennett, Dr. Viola Cassidy, and Dr. Walter Ersing whose suggestions were gratefully accepted and incorporated in this report. Mrs. Loetta Hunt, a specialist in working with blind children, was very helpful as a consultant.

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The many friends who helped in every way are too numerous to list, but their contributions will not be forgotten.

Last, and perhaps most important, are those to whom this study was directed--the blind children who provided stimulation to the investigator throughout the study.

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FIELDS OF STUDY

Major Field: Physical Education

Studies in Physical Education and Health Education. Professor Margaret A. Mordy

Minor Field: Guidance

Studies in Guidance and Counseling. Professors Anthony Riccio and Gratton C. Kemp

CONTENTS

		Page
DEDICATION		ii
ACKNOWLEDGMENTS		iii
VITA		iv
TABLES		vi
CHAPTER		
I	INTRODUCTION	1
II	REVIEW OF RELATED LITERATURE	12
III	PROCEDURE	44
IV	ANALYSIS OF THE DATA	61
V	SUMMARY AND CONCLUSIONS	76
APPENDIX		83
BIBLIOGRAPHY		141

TABLES

Table		Page
1	Mean scores of figures and drawings	63
2	Summary of subject errors	65
3	Mean scores of subjects in rank order	68
4	Subject scores and intelligence quotients by grade and sex	69

CHAPTER I

INTRODUCTION

The learning of motor skills by seeing persons is highly dependent upon visual faculties. To facilitate the development of a skill, the learner may see a demonstration or observe others perform. These observations supplement and, at times, replace a verbal explanation.

The blind child has no such visual advantage. He "observes" differently from the seeing. Present methods of teaching physical education to the blind child include verbal description, tactually "seeing" the performance by palpating those body parts involved in the teacher's or demonstrator's movement, and placing the blind child in the proper position.[1] To teach children individually is paramount in light of present teaching methods, according to Heim.[2]

Generally, it takes longer to teach a skill to blind children than to the seeing, and as a result, the blind child learns more slowly.[3] Unless the teacher is organized to the extent that

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[1]H. Harrison Clarke and David H. Clarke, Developmental and Adapted Physical Education (Englewood Cliffs, New Jersey: Prentice-Hall, Inc., 1963), p. 313.

[2]John J. Heim, "Physically They See," Journal of Health, Physical Education, and Recreation, XXIX (May, 1958), 36.

[3]Rudolph Pintner, Jon Eisenson, and Mildred Stanton, The Psychology of the Physically Handicapped (New York: Appleton-Century-Crofts, 1941), p. 239.

while he is working with one child others in the class are active, much of the physical education period may be spent waiting in line.

As a result of these time-consuming methods, the teacher's inability to cope with blind children, and because of fear of injury to the blind child during play, the blind child in a regular school is often relegated to a study hall. Benefits of physical education are usually denied those with little or no vision.[4]

Although placing the child in desired positions and palpation are time-tested methods of teaching the blind child, they obviously carry disadvantages in addition to those mentioned above. Through their extensive use, the child may develop a dependence on others for his learning experiences. The blind child, like any other, needs to learn mature independence. If he sees himself as helpless, he will soon become helpless.[5] He may be unable to grasp the total movement by feeling only those body parts involved. Aerial movement may be difficult to comprehend. These methods may be time consuming and burdening to the teacher. In addition, there is a need to supplement existing methods with others. A host of methods are used with the seeing by taking advantage of their visual sense. With additional research, a wider range of compensatory methods may be available for the education of blind children by capitalizing upon a well-developed tactual sense, which for some practical purposes replaces a lack of visual acuity.

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[4]Charles E. Buell, Active Games for the Blind (Berkeley, Calif.: C. E. Buell, 2722 Derby Street, 1953), p. 3.

[5]Marietta B. Spencer, Blind Children in Family and Community (Minneapolis: University of Minnesota Press, 1960), p. 39.

Statement of the Problem

This investigation was an exploratory study to develop and test the effectiveness of an embossed notation system of teaching the identification of static body positions to the blind. Representations of human figures in various static positions, as well as representations of movement sequences, were embossed on 9½ by 11½ inch plastic Brailon sheets.

The primary question being investigated is: Can blind children learn to read and interpret embossed drawings of human figures as they represent positions found in selected motor skills? To satisfy this question the following problems were investigated: (1) what is the nature of faults which occur in recognizing and describing various body parts as they are represented on embossed drawings? (2) what types of errors occur in determining the direction of the human body in terms of a front view or side view, as depicted on embossed drawings? (3) what types of errors occur when distinguishing the right and left body parts of figures on embossed drawings? (4) what types of errors are presented when blind children determine the relationship of the body and body parts to the floor or baseline? (5) what is the nature of faults in recognizing positional differences of limbs?

Significance of the Problem

Research has been completed to verify a pressing need for the blind people to have continual experience in spatial orien-

tation.[6] These needs are being partially fulfilled by sensory training programs operating in some residential schools for the education of blind children. Physical education classes can enrich the experiences of the blind child by providing opportunity for the child to orient himself in space as well as to become familiar with his own body parts and to discover their possibilities and limitations in movement.

Present methods of teaching blind students motor skills were previously mentioned. New methods must continuously be sought to further enhance the learning experiences of the blind. Carroll states that the use of every source of information is important.[7] Daniels and Davies believe that research is needed in methods of teaching or presentation and supervision of sports. They ask if there are yet unexplored ways and means of guiding learning situations for best results.[8] Taylor agrees with Daniels and Davies when he states that "there needs to be more widespread original research as to (1) the kind of activities suited to the visually handicapped, and (2) the methods of teaching these activities to the visually handicapped."[9] Taylor further finds that methods in physical education need experimentation and revision, and that the

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[6]Miriam Norris, Patricia Spaulding, and Fern Brodie, Blindness in Children (Chicago: University of Chicago Press, 1957), p. 14.

[7]Thomas J. Carroll, Blindness (Boston: Little, Brown, 1961), p. 110.

[8]Arthur S. Daniels and Evelyn A. Davies, Adapted Physical Education (New York: Harper and Row, Publishers, 1965), p. 272.

[9]Wiley W. Taylor, "Physical Education for the Blind and Partially Sighted" (unpublished Master's thesis, The Ohio State University, 1951), p. 64.

teaching of physical education to blind students needs to be conducted as a specialized phase of education.[10]

Ferri expressed a need specifically for sensory training.

> It is obvious that a greater and better use of data provided by the senses might contribute to make the intelligence of the blind considerably richer and sharper, filling their imagination with new elements, even though some of them may not have a direct relation to space and movement.[11]

He emphasizes that it is absolutely essential to continuously feed the imagination of the sightless by means of a wise and well-balanced education, in the course of which numerous opportunities should be provided for outward projection. He believes that this is "the best manner in which to gain a wealth of images, thus favouring a learning process in a practical, active and specific field."[12]

Others advocate a richer multi-sensory approach to learning for the blind student. Rubin stresses this concentration particularly in the early school years.[13] Parmalee believes that without stimulation in other sensory areas, the child may encounter social and sensory isolation.[14]

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[10] Ibid.

[11] Orfeo Ferri, "The Dynamics of Learning," The Educator (International Conference of Educators of Blind Youth, No. 4, Dec. 1965), p. 12.

[12] Ibid., p. 12.

[13] Edmund J. Rubin, Abstract Functioning in the Blind (New York: American Foundation for the Blind, Research Series, No. II, 1964), p. 12.

[14] A. H. Parmelee, M. G. Cutsforth, and C. L. Jackson, "Mental Development of Children with Blindness Due to Retrolental Fibroplasia," AMA Journal of Diseases of Children, XCVI (March, 1958), 64.

The present study was undertaken to fulfill some of the needs cited by these writers. Deprived of the most frequently called upon sense in the seeing, blind persons must utilize tactual and other senses to their fullest. There has been a trend in recent years toward the use of tactual aids in the education of blind children in the form of objects such as stuffed animals and other objects reduced in scale.[15]

Although a few studies have been completed relating to the use of maps and raised line drawings, none have been conducted in relation to embossed representations of the human body depicting static body positions. If blind children can identify the body parts and positions when they are represented by embossed drawings, then the child may develop a greater understanding of the body's potential for movement. Increased understanding of movement could broaden the scope of the child's experiences.

Just as learning occurs differently among seeing individuals, so it does with blind individuals. For this reason, varied methods of teaching should be explored in an educational setting. Some children respond to verbal instruction, while others appear to be somewhat visually oriented during their learning experiences. The blind child, too, should be offered a variety of means to achieve his goals.

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[15]Richard A. French and David H. Morgan, "Aids in Education and Recreation," What of the Blind?, ed. Helga Lende (New York: American Foundation for the Blind, 1941), p. 74.

Purpose of the Study

A purpose of the study was to determine the feasibility of using embossed figures representing movement sequences and static postures as a teaching method for blind children. A second purpose, which was equally important, was to determine methods of orientation needed to facilitate the use of the drawings by blind children.

Assumptions and Limitations

The study was conducted at the Ohio State School for the Blind. No conclusions can be drawn concerning students in other residential schools or other blind students in non-residential schools.

Only students born blind or blinded in infancy were used in the study. Implications were not drawn for later blinded children. One subject, accidentally blinded at age ten, was inadvertently included in the training sessions. Data concerning his testing were not included in the results of the study. Photographs of the drawings along with transcriptions of his interpretations of the drawings may be found in Appendix A.

Only selected movement sequences and postures were included in the study. There was no attempt to utilize all movement possibilities. It is conceivable that only certain types of movement would lend themselves to this method.

Subjects with an age range of from 11 to 16 were selected from the fifth, seventh, and eighth grades. No attempt was made to train or test students below or above those age or grade levels.

To ensure educability to the method, subjects were limited to those with intelligence quotients of 90 or above, as shown by the Interim Hayes-Binet Scale.

Since no attempt was made to control the many variables, only descriptive statistics were used.

Definition of Terms

Blindness--Legally, those with visual acuity of 20/200 or less with glasses are considered blind. For purposes of this study, a subject was used who did not have light or form perception which would enable him to see drawings, objects, or individuals. Additionally, only individuals blind at birth or during infancy were used in the study to prevent the possibility of visual memory affecting the reading and interpretation of drawings. Throughout this study the term "blind" refers to those children blind at birth or during infancy.

Drawing--As used in this study, the term "drawing" refers to embossed representations of either a static position or to sequential movement. A drawing may consist of just one figure or there may be as many as five figures involved. In this study 40 drawings were used, 20 of which were selected for training and 20 for testing. Within the 40 drawings, there were 99 human figures represented. All 40 drawings are included in Appendix A.

Intelligence Quotient--The intelligence quotient of students at the Ohio State School for the Blind was measured by the Interim Hayes-Binet Scale. Many of the subjects had not been tested since

1959. Only five subjects were tested later than 1965. The latest available test scores were used in selecting subjects.

Orientation--As used in this study, orientation refers to that amount of training necessary to acquaint subjects with and to develop reasonable proficiency in the reading and interpretation of the drawings.

RLF--The majority of subjects used in this study became blind because of Retrolental Fibroplasia, commonly stated as RLF. Between 1949 and 1954 this condition caused blindness in prematurely born babies. Lowenfeld notes that "it was found in 1954 that the major cause of this condition was the administration of high concentration of oxygen over prolonged periods of time to prematurely born infants."[16] The problems causing RLF have been somewhat resolved, but it remains the major cause of blindness in present school-age children.

Sequential Movement--Sequential movement is interpreted to mean a change of body position from one point in space to another. This would involve such movement as walking, running, and a forward roll. Sequential movement may involve a forward or backward change of position or it may comprise simply a change in arm position from one point in space to another, for example.

Static Position--As used in this study, static position refers to a stationary position in which no movement is entailed.

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[16]Berthold Lowenfeld, "Psychological Problems of Children with Impaired Vision," Psychology of Exceptional Children and Youth, ed. William Cruickshank (2d ed. rev.; Englewood Cliffs, New Jersey: Prentice-Hall, Inc., Publishers, 1963), p. 230.

This would include such postures as standing, sitting, lying, and squatting. Many of the drawings employed in this study consisted of such static positions.

Subjects--Subjects were selected from among students attending the Ohio State School for the Blind. The class standings were those of the 1966-1967 school year. Students were selected according to various criteria from the fifth, seventh, and eighth grades. Blind children are frequently behind their sighted peers of the same age in terms of grade placement. The age difference may accrue to three years. The age range of subjects included in this study was from 11 to 16.

Testing Drawings--Those drawings which were used to test the subjects included side views and front views at various body levels, in both static positions and in sequential movement. Within the 20 drawings there were 51 figures.

Training Drawings--Those drawings which were used for the orientation of the subjects to the various body parts and positions included side views and front views at various body levels, in both static positions and in sequential movement. Within the 20 drawings there were 48 figures.

Overview of the Study

This study sought to explore the potential use of embossed figures representative of the human body as a teaching method to a group of children blind at birth or in infancy. It is hoped that their value might serve as a method or as an aid, just as pictures and demonstrations are utilized as aids for sighted students.

The first chapter included introductory remarks, the statement of the problem, the purpose of the study, the rationale for the study, limitations and assumptions, and definition of terms.

The second chapter dealt with related literature including an analysis of other studies pertaining to embossed materials. Only two studies were found which directly relate to the recognition of embossed human figures. Others were included to strengthen the foundation of the present investigation.

Chapter III concentrated on the design of the study. Included here was the method of designing and selecting the drawings, the selection of subjects and the training and testing procedures.

Chapter IV presented the data and the analysis of the data. Figures and tables were included to show relationships between and among various subjects and drawings.

Finally, the last chapter restated the problem and included a summary and conclusions regarding the investigation and suggested implications for further research.

CHAPTER II

REVIEW OF RELATED LITERATURE

There is an impressive store of literature about blind children. Those areas of the literature which pertain directly or indirectly to this study are considered in this chapter.

The first part of this chapter expresses the need for studies and research related to physical education for blind students, especially those concerned with posture, spatial orientation, and object perception, and the need for new teaching methods in these areas. A limited amount of research has been completed in embossed diagrams and raised line drawings according to investigators interested in that phase of the education of blind children. Because visual sense, body orientation, and tactual sense relate to this study, some mention of these research efforts are included in this chapter.

Opinions of educators and others working with blind persons are recounted. Their statements and ideas have been formulated through completed research of others, but mainly have come about through extensive observation. Scientific research with the blind people is difficult to conduct because of the many variables and because of the wide geographic spread of subjects who are blind. Rubin is an exception as one who has carefully controlled all variables. However, he conceded that it is difficult to gather

enough subjects with similar factors.[1] Lowenfeld further summarized this point. "The comparatively small number of blind children with the resulting wide scatter in age, intelligence, socioeconomic background, and geographic location has retarded research. It makes research based on large groups rather difficult and often impractical."[2]

As a result of so many variables, studies are frequently at opposite poles in their findings. There is considerable debate among researchers, for instance, about the degree to which a blind child is confused by the use of visual terms denoting color, brightness, and perspective. Likewise, there is controversy about the value of embossed diagrams, charts, and drawings in the education of the blind. In the latter part of this chapter, these topics are explored, both on the basis of opinion and of completed research.

Studies Related to Physical Education

It has been generally agreed that physical education is a tremendously important facet of the education of blind children. Total movement experience is limited because of the nature of the disability. In addition, an accurate body image is difficult to achieve and maintain because of the lack of vision. French and Morgan asserted that "the sightless tend to stoop because they have

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[1]Edmund J. Rubin, Abstract Functioning in the Blind (New York: American Foundation for the Blind, Research Series, No. II, 1964), p. 18.

[2]Berthold Lowenfeld, "Psychological Problems of Children with Impaired Vision," Psychology of Exceptional Children and Youth, ed. William Cruickshank (2d ed. rev.; Englewood Cliffs, New Jersey: Prentice-Hall, Inc., 1963), p. 230.

no visual standard for checking their stance. They must learn correct posture deliberately."[3] Fait concluded that while visual example is a reason for poor posture, it may be poor also because of lack of strength in postural muscles.[4] In his Master's thesis Taylor described this typical posture as one of slumping down with the head forward and the feet turned outward.[5]

Siegel suggested three requirements of the individual before good posture can be effected. He believes there must be "(1) adequate spatial orientation including a valid concept of the vertical; (2) well conditioned postural reflex mechanisms; and (3) an appropriate and accurate body awareness, against which stance and motion can be patterned."[6] He found that particularly in those blinded at birth there is no accurate concept of verticality so necessary for proper orientation.[7] Physical education and mobility training should direct their attention toward developing good posture which, according to Siegel, is almost always synonymous with adequate kinesthetic awareness. He contended that blind persons model their posture against body awareness and image and that these are frequently in error.[8]

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[3]Richard A. French and David H. Morgan, "Aids in Education and Recreation," What of the Blind? ed. Helga Lende (New York: American Foundation for the Blind, 1941), p. 14.

[4]Hollis Fait, Adapted Physical Education (Philadelphia: W. B. Saunders Company, 1960), p. 136.

[5]Wiley W. Taylor, "Physical Education for the Blind and Partially Sighted," (unpublished Master's thesis, The Ohio State University, 1951), p. 18.

[6]Irwin M. Siegel, "The Expression of Posture in the Blind," The International Journal for the Education of the Blind, XV (October, 1965), 23.

[7]Ibid.

[8]Ibid., pp. 23, 24.

Physical educators and workers with blind children emphasize posture training and other movement experiences as necessary in their education and urge that new methods be explored. Inactivity as well as lack of body awareness contribute to postural problems.

Taylor found that the blind child tends to become inactive, dependent upon others for support and guidance and easily loses confidence in himself.[9] By increasing the scope of physical activity, these characteristics may become less manifest.

Frampton believed that physical education experiences should be used which provide opportunities for independence.[10] Pearson strengthened the argument for a great deal of physical education for blind children. She believed that gross motor movement enhances the child's ability to learn mobility and strengthens his interest in his surroundings.[11]

Many writers have discovered that spatial orientation is lacking and that this is a very important factor in the ability of blind people to mobilize or move about in their environment. They are in accord that extensive mobility opportunity and spatial orientation enhances the blind child in other learnings. Gary and Ascarelli placed import in space perception. "Perception of self, orientation, object perception, and language are essential aspects

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[9]Taylor, p. 18.

[10]Merle Frampton, Education of the Blind; A Study of Methods of Teaching the Blind (New York: World Book Company, 1940), p. 78.

[11]Kathleen Pearson, "Taking a New Look at Physical Education," The New Outlook, LIX (November, 1965), 315-317.

of spatial organization."[12] Their research was carried out in the realm of spatial relations of the blind.

> Data obtained through the administration of a Spatial Relations Performance test to a group of about seventy totally blind children between the age of 5 and 15 furnished the evidence that about fifty per cent of this group, regardless of chronological age or intelligence quotient, had difficulties which centered around the understanding and application of spatial concepts and resulted in poor orientation, lack of manipulative skills, and limited interest in environment.[13]

Bauman administered tests from which she found that orientation in space comes slowly. She took exception to other educators when she suggested that, since blind people do best in tasks in which space orientation is least important, they be taught to use tools which will require little spatial knowledge.[14] Most writers believe that since blind people live in a visual world involving movement they should be prepared to take their place in it.

Physical education should be concerned about its role in space orientation. Norris, Spaulding, and Brodie wrote that "the totally blind child may be particularly dependent upon favorable opportunities for learning if he is to move about freely: in particular, opportunity for wide experience in the development of gross motor skills."[15] According to Wienke, the physical education

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[12]Ralph Garry and Anna Ascarelli, "Teaching Topographical Orientation and Spatial Organization to Congenitally Blind Children," Journal of Education, CXLIII (December, 1960), 3.

[13]Ibid.

[14]Mary K. Bauman, "Studies in the Application of Motor Skills Techniques to the Vocational Adjustment of the Blind," Journal of Applied Psychology, XXX (May, 1946), 153.

[15]Miriam Norris, Patricia Spaulding, and Fern Brodie, Blindness in Children (Chicago: University of Chicago Press, 1957), p. 60.

class offers a myriad of opportunity for the development of mobility. "To be mobile one must understand the relationships of space, balance, and movement."[16]

Hunter proposed that sports and physical education be a part of spatial orientation training. He stipulated that successful orientation is required during such sports as swimming, bowling, horseback riding, and golf.[17] That spatial orientation aids the blind child to take his place in a seeing world is accepted by most workers of the blind. Physical educators need to recognize their role in this important part of education for blind people.

In spite of a consensus in favor of physical activity and physical education, Buell found in 1953 that in most states standards of physical education were low. Reasons cited were "(1) lack of equipment, (2) low salaries, (3) frequent change in personnel, and (4) unprepared teachers."[18] At the Ohio State School for the Blind, which employs one male and one female physical educator, there has been a turnover of three women and two men in three years. Albeit all were enthusiastic and willing to learn, none were prepared to work with blind children prior to their employment.

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[16]Phoebe Wienke, "Blind Children in an Integrated Physical Education Program," The New Outlook for the Blind, LX (March, 1966), p. 74.

[17]William F. Hunter, "The Role of Space Perception in the Education of the Congenitally Blind," International Journal for the Education of the Blind, XI (May, 1962), 130.

[18]Charles E. Buell, Active Games for the Blind (Berkeley, Calif.: C. E. Buell, 2722 Derby Street, 1953), p. 3.

Types of activity vary considerably. Most often calisthentics, track and field, football, basketball, baseball, group games, stunts, wrestling, rhythmics and dance are found in blind schools. Few programs offer swimming and bowling.[19] A wide variety of activity should be offered. Spencer believed that "to encourage the mental growth of the blind child, every effort should be made to allow him to participate as widely and as actively as possible in activities of all kinds."[20] Physical education can and should contribute heavily to this objective.

Methods of Teaching

Writers diverged in their suggestions for teaching methods, but all concurred that no one method is satisfactory for all students.

Grutzmacher, in a dissertation on swimming methods, explored three methods of teaching swimming to blind children. Although the instructional method seemed most satisfactory, she found that two others, mind-picture games and artificial aids and music, opened new horizons of experience for many students. She concluded that no one method is best for all blind and partially seeing children and that no method should be ignored.[21]

Fait, among others, found that in introducing new skills, a kinesthetic approach is essential. The specifics of this has been

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[19]Taylor, p. 51.

[20]Marietta B. Spencer, Blind Children in Family and Community (Minneapolis: University of Minnesota Press, 1960), p. 49.

[21]Jean Grutzmacher, "An Evaluation of Three Experimental Methods of Teaching Swimming to Blind and Partially Seeing Children," (unpublished Doctoral dissertation, The Ohio State University, 1960), pp. 98-99.

discussed previously. He also encouraged the use of descriptions which would accompany the kinesthetic approach but warned against lengthy verbal explanations preceding the skill presentation.[22]

Rubin's statement concerning methods of learning presented a slightly different approach. He stated that "perhaps increased training on reasoning tasks in the early school years and efforts to provide a richer multi-sensory approach to learning would be beneficial to the blind student."[23] Parmelee stressed the use of remaining sensoria. "Bereft of one important sense the blind child needs additional stimulation in other sensory areas rather than the social and sensory isolation he often encounters."[24] Buell urged not only a variety of methods but special methods adapted specifically to the teaching of students who are blind.[25]

As a means of providing additional sources of information, there has been a trend in recent years towards the use of tactual aids for the blind, in the form of objects.[26] French and Morgan attested that "the blind child, even more than the sighted one, needs such 'visual' aids if he is to comprehend many of the concepts which he should be taught in school."[27] While utilizing such "visual" aids Ferri warned that care needs to be exercised "at

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[22]Fait, p. 141.

[23]Rubin, p. 51.

[24]A. H. Parmelee, M. G. Cutsforth, and C. L. Jackson, "Mental Development of Children with Blindness Due to Retrolental Fibroplasia," AMA Journal of Diseases of Children, XCVI (March, 1958), 64.

[25]Charles C. Buell, Sports for the Blind (Michigan: Edwards Brothers, Inc., 1947), p. 5.

[26]French and Morgan, p. 74.

[27]Ibid.

emphasizing what is essential above everything else, to acquire an idea of wholeness."[28] He exerts that tactual training is an essential in the education of blind children.[29]

Object Perception

Limited research has been completed relating to the blind person's ability to perceive objects. The relationship between this research and the present study is in the tactual perceptual ability of blind children as well as in the ability to discern familiar objects. Without these potentials, it could hardly be expected that blind children could interpret drawings of objects or of people.

Ayres tested the performance of early blinded and adolescents blinded at birth in two tasks, one of which was selective perception and verbalization of free form plastic and wooden shapes and the other the identification of a toy boat, a toy pipe, and a plastic pear. Although there was not a difference in verbal responses made about the free forms, there was a significant difference in the accurate recognition of objects, the seeing subjects recognizing objects tactually more readily.[30]

Others have found that blind people and seeing perform about equally in tasks of object recognition. Ewart and Carp, using five blocks with one as a stimulant block, had subjects choose out of

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[28] Orfeo Ferri, "The Dynamics of Learning," The Educator (International Conference of Educators of Blind Youth, No. 4, Dec. 1965), p. 10.

[29] Ibid.

[30] Abbie F. Ayres, "A Comparison of Selective Perception Among Early Blinded and Sighted Adolescents" (unpublished Doctoral dissertation, Rutgers--The State University, 1966), pp. 135-136.

the remaining four the one that was like the stimulant block. They also used a semicircle, quarter-circle, and a triangle and found that both blind and seeing subjects made more errors on these, with the fewest errors occurring in the identification of a circle and a crescent. They concluded that visual imagery is not a critical factor in this kind of form recognition.[31] These results confirmed Worchel's that visual imagery is not a critical factor in form recognition.

Worchel conducted exhaustive studies on tactual form perception in 1951, comparing blindfolded sighted, those blind at birth and later blinded subjects. Subjects identified objects such as circles, crescents, and squares. They compared like objects and in addition reproduced the objects through drawings. He found that blind people were slower than the seeing at apprehending even simple relationships, but that on the test of form recognition, the blind at birth did as well as the accidentally blinded and sighted subjects. He concluded that recognition does not require visual imagery. According to Worchel, blind subjects did badly on drawing reproductions of the forms but did much better on the verbal report. He believed that poor drawings may have been the result of lack of experience.[32]

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[31]Anne G. Ewart and Frances M. Carp, "Recognition of Tactual Form by Sighted and Blind Subjects," American Journal of Psychology, LXXVI (September, 1963), 489-490.

[32]Philip Worchel, Space Perception and Orientation in the Blind ("Psychological Monographs: General and Applied," Vol. LXV, No. 15; Washington, D. C.: The American Psychological Association, 1951), pp. 12-13.

In Worchel's second experiment of tactual space relations, those born blind did not fare as well. In this test one part of a form was placed in one hand and the other part in the other hand. Subjects were asked what form would result if the parts were placed together. Visual imagery seemed to have led to better performance by sighted subjects.[33]

Verticality

Some research has been conducted to determine the blind child's ability to distinguish vertical and horizontal axes. Bitterman and Worchel concluded that "the blind are better oriented to principal axes of space than are sighted Ss deprived of visual stimulation."[34] To draw their conclusions they tested blindfolded seeing and blind subjects in an upright position during which they found that both groups performed at the same high level, but with their bodies tilted, the performance of both groups deteriorated with blind subjects being more accurate than the sighted.[35] These results conflicted with those of Siegel which were discussed previously, and which stipulated that there is no accurate concept of verticality, particularly in those blinded at birth.

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[33] Ibid., p. 16.

[34] M. E. Bitterman and Philip Worchel, "The Phenomenal Vertical and Horizontal in Blind and Sighted Subjects," American Journal of Psychology, LXVI (July, 1953), 602.

[35] Ibid.

Hunter supported Bitterman and Worchel in his tests of verticality of the blind versus the sighted. He used a ruler vertically placed to test the ability to judge straightness. He attributed the blind's greater success to constant use and training of the tactual-kinesthetic sense.[36] He formulated the supposition from the data that

> perceptual judgments of any sort become less variable with practice; that practice in tactile-kinesthetic perceiving increases with age; and that, because of the greater part it plays in their reading, writing and perception of the world generally, the blind have "more" experience of tactile-kinesthetic judgment than the sighted.[37]

He found that blind subjects, both as individuals and as a group, were finer in their judgments and that they were more consistent.[38]

Birch and Lefford confirmed a need for practice in their study concerning the development of intersensory functioning in normal children of school age. They found that "information received by young children through one avenue of sense is not directly transduced to another sense modality."[39] In fact, they argued that possibly intersensory equivalence is developmental.[40]

Relief Designs and Drawings

Writers and workers with blind people disagreed adamantly about the sagacity of employing embossed drawings for blind children.

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[36] Ian M. Hunter, "Tactile-Kinesthetic Perception of Straightness in Blind and Sighted Humans," Quarterly Journal of Experimental Psychology, VI (Part 4, 1954), 149.

[37] Ibid., p. 152.

[38] Ibid.

[39] Herbert Birch and Arthur Lefford, Intersensory Development in Children ("Monographs of the Society for Research in Child Development," Vol. XXVIII, No. 5, 1963), p. 43.

[40] Ibid., p. 43.

Some affirmed that with training the blind child can utilize drawings as effectively as or even in lieu of the written word by applying their tactual sense. Others maintained that embossed diagrams of objects serve only to impose sighted visual concepts on the blind child and that he must learn to function in a visually oriented world interpreting all concepts of objects through other sensoria. While some debated that the child needs no knowledge of perspective to relate in his world, others are convinced that the child should understand this as a part of the climate in which he exists.

Few studies have been completed which relate to this facet of education for blind people; most material is derived from opinion based on observation. This section will describe first those studies and writings dealing with opposition to the use of relief design in the education of blind students and second, those which favor the use of embossed diagrammatic material.

Opposition to embossed design

Cutsforth, one of the early and well respected writers about the blind persons, contended that visual dynamics represented by posture, movement, and attitude fails to develop for touch. He pointed out that "what is visually simple is tactually complex."[41] He further postulated on the topic.

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[41]Thomas D. Cutsforth, The Blind in School and Society: A Psychological Study (2d ed. rev.; New York: American Foundation for the Blind, 1951), p. 169.

> Experimental work on tactual perception has shown the extent to which touch is unable to grasp conventional and typified visual meanings and relationships. . . . Embossed outline pictures, plaster casts in bas-relief, parts of objects, and mounted animal figures all fall short, under tactual examination, of producing the perceptual wholes or meanings that vision produces.[42]

While referring to the use of stuffed animals as a means of tactual appreciation, Cutsforth found that "touch and vision are two distinctly different forms of experience."[43] He reasoned that while palpating a non-living, non-breathing, cold stuffed animal, a child fails to derive the impact of the true qualities of the moving, living animal. He further explained this by writing that "tactual perception, no matter how well trained, carries with it a meaning of literal realism which does not permit the grasp of ideal meanings."[44]

Cutsforth used as an example difficulties of blind children trying to perceive statues of animals or men depicting movement. He found that a blind man, knowing about the details of a statue, was unable to recognize it upon tactual examination. He concluded that

> if tactual examination cannot reveal the dynamic relations in tridimensional figures that obviously imply movement when visually perceived, there is little use for the blind to decipher or pretend to perceive the meaning in representations of men or animals in action.[45]

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[42] Ibid., p. 170.
[43] Ibid.
[44] Ibid.
[45] Ibid., p. 172.

Cutsforth further decried the use of tactual form when he exerted that the blind individual does not perceive the same form with his fingers that one sees with his eyes. He emphatically stated that

> if seeing subjects are not able to reproduce tactual form and extent from their own tactual experience when they have had a lifelong process of verification of these two senses, it can hardly be expected that the blind child who either has no visual memory or whose visual memory is divorced from reality can perceive objects as the seeing perceive them.[46]

Cutsforth criticized the imposition of visual concepts on blind children without offering any real alternates, other than to experience real objects. He agreed that the child is unable to experience tactually a moving animal or human being. He conceded that "since the blind live in a world of the seeing, it is necessary to procure visual aid and information."[47] While not advocating the use of visual aids, he recognized that they are an essential for the survival of blind individuals.[48]

Lowenfeld tended to agree with many points brought forth by Cutsforth. He found that "cut-out wooden forms shaped like animals or dolls are without meaning for blind children."[49] He admitted that if there is some sight, they may be usable, along with other playthings which make use of color or two-dimensional

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[46] Ibid., p. 174.

[47] Ibid., p. 73.

[48] Ibid.

[49] Berthold Lowenfeld, Our Blind Children: Growing and Learning With Them (Springfield, Illinois: Charles C. Thomas, Publisher, 1964), pp. 73-74.

forms.[50] Lowenfeld agreed with Cutsforth that the educator "must make every effort to have his children experience the world through their own senses without imposing upon them the visual approach that dominates his own observations, experiences, and imagery."[51] According to him, the blind child's own sensory experiences need to be exploited. Not using a visual approach "should not create a different world for the blind child, but rather lead to a fuller utilization of those sensory aspects of objects and situations which he can experience with his own senses."[52]

Writing in Cruickshank's Psychology of Exceptional Children and Youth, Lowenfeld spoke against the use of embossed drawings for blind children. He noted that the hands of the blind child observing the actual object by touch move in three dimensions and embrace the object. This renders the embossed outline as a symbol of the object, not as a representation. The outline, therefore, becomes meaningful only with verbal interpretation and explanation.[53]

The investigator of this study wrote Dr. Lowenfeld regarding the advisability of the present study during its inception. In his reply, which may be found in full in Appendix F, he discouraged such a study on the same basis as his above writing. He referred to an article in the New Outlook which was then perused,

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[50] Ibid.

[51] Berthold Lowenfeld, "The Child Who is Blind," Journal of Exceptional Children, XIX (December, 1952), 99.

[52] Ibid., p. 100.

[53] Lowenfeld, Psychology of Exceptional Children . . ., p.247.

but the article contested mainly the use of color and painting of pictures by blind people.[54]

However, as has been reported, many educators, especially those completing research in the 1930's and the 1940's, confirmed Lowenfeld's thinking that embossed representations are not practical in evoking real meaning for the blind child.

The only early research which provided concrete evidence regarding the use of embossed drawings has been produced by the Merrys. In their preliminary study they dealt with the ability of blind children to interpret embossed pictures. Designed with a dressmaker's wheel, drawings included a cup, a chair, a horn, a table, a fork, a hat, a shovel, a wheel, and an apple. Thirty per cent of the 50 subjects made zero scores in ability to identify the objects shown on the drawings.[55]

The Merrys conducted two experiments to follow up their pilot study. The first attempted to determine whether similar results could be determined by using a larger number of subjects using pictures of both bi-dimensional and tri-dimensional objects. The subject was allowed 60 seconds to respond. Failure to do so resulted in a zero score. While a perfect response was worth two points, a subject could earn one point if his response was similar in idea but not absolutely correct. An example was to call a triangle a tent. The 98 pupils ranged in age from 6 to 24 with a median age of 14.

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[54]Charlotte Haupt, "Self-Realization--But Not Through Painting," The New Outlook for the Blind, LX (February, 1966), pp. 43-46.

[55]Ralph V. Merry and Frieda K. Merry, "The Tactual Recognition of Embossed Pictures by Blind Children," Journal of Applied Psychology, XVII (1933), pp. 148-149.

Objects drawn for this study in the bi-dimensional category were a square, a cross, a triangle, a star, and a circle. Objects of tri-dimensional properties used were a shovel, a house, a man's shoe, a rabbit, a chair, a table, a pitcher, a stovepipe hat, scissors, and a wheel. The first part of the testing, involving the bi-dimensional objects, was referred to as the designs test, whereas the tri-dimensional section was referred to as the pictures test. The highest possible score on the designs test was 20. Of the 98 subjects, 33.67% reached that score, and the median of the group was 17. There were no zero scores and no differences between sexes. The highest possible score on the pictures test was 42. The highest attained was 29 and 15.78% of the subjects received zero scores. There was no report of training prior to reading the designs and pictures. A major conclusion drawn from the first experiment was that the ability of blind children to recognize tactually simple embossed designs is very limited.[56]

The second experiment had as a primary purpose "to determine how much the systematic teaching of perspective and the principles of graphic representation may improve the ability of blind pupils to recognize tactually embossed designs and pictures."[57] To accomplish this training, models of the objects were used. Subjects first felt the three-dimensional objects, then learned to recognize them on embossed drawings and to reproduce them with tacks on a cushion. There were only 15 subjects in this experiment.

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[56] Ibid., pp. 150-154.

[57] Ibid., p. 150.

Teaching sessions were conducted for five-minute periods three times a week for 15 weeks. Human figures were used as follows: Parts of the body, front and side views and peculiar positions, e.g., a boy with his hands on his hips, were called to the children's attention. No mention was made of a human model or use of a human being before the presentation of the embossed pictures.

The results of the second experiment indicated some improvement in the ability to recognize bi-dimensional embossed drawings, but improvement was not statistically significant in the recognition of tri-dimensional forms as a result of instruction. There was a marked increase in scores when the examiner furnished a clue to the recognition of the pictures. Thus, the Merrys concluded that if pictures are to be used in braille books, there should be an adequate description. They further found that the first experiment was a more reliable test of the subjects' native abilities.[58]

The Merrys' conclusions allowed leeway for the use of embossed materials in the teaching of geometry, geography, and other subjects involving two-dimensional objects such as a wheel, a hand, or a pair of scissors, but they doubted that tri-dimensional objects, involving the use of perspective, possesses any real meaning for the sightless, even after systematic instruction.[59] They summarized their findings with the following statement.

> Although exceptional blind individuals may be able to reproduce drawings employing the principle of perspective,

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[58] Ibid.

[59] Ibid., p. 163.

> it seems unwise to encourage any extensive teaching of pictures representing objects in three dimensions, unless used occasionally as a source of enrichment for mentally superior blind children.[60]

Further, the Merrys questioned the real significance graphic representation carries for blind children. "Instead of giving reality to their idea of things we may be increasing vagueness and verbalism, a criticism which any progressive teacher of blind children wishes to avoid."[61]

Support for embossed drawings

The Merrys, Lowenfeld, and others have attempted to dispel the widely held notion that the blind person is endowed with a compensatory extra-sensory acuity. In contrast to the Merrys' hypothesis, others believe that the tactual sense should be developed and put to use as one additional channel of communication. Lowenfeld and Cutsforth have expressed distaste over imposing visual concepts of the sighted onto blind people, but there are others who contend that every means of communication should be exploited and that blind individuals can derive tactual meaning and interpretation from the use of models and embossed drawings. As will be shown, there are educators who find that since those who are blind live and function in a seeing world, they must understand it as completely as possible. Thus, a blind person needs to find meaning about such visual terms as, for instance, perspective.

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[60] *Ibid.*

[61] *Ibid.*

Tactual thinking

Axelrod concluded in a study concerning the performance of blind children on auditory and tactile tasks that the data did not support the theory of compensation of senses. Rather, the differences in sensitivity depended upon the finger being tested along with other factors.[62] Carroll found that touch senses are not automatically sharpened by blindness, but that they can be developed by training.[63] Hunter supports Carroll when he states that "research indicates that the initial sensory acuteness of the blind is no better than that of the sighted, and whatever they achieve is a result of necessity, concentration and increased practice and skill."[64]

Fisher found that "after vision, the most important of the spatial senses are tactile-kinesthesis and audition."[65] Although he found the tactile sense most important in his experiments on dominant sensory modalities, Fisher had one subject, blind from birth, in whom audition appeared to be the dominant modality.[66]

Visualization

A considerable amount of conjecture has been projected in terms of the role of visualization in relation to the tactual sense.

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[62] S. Axelrod, Effects of Early Blindness: Performance of Blind and Sighted Children on Tactile and Auditory Tasks (New York: American Foundation for the Blind, 1959), p. 71.

[63] Thomas Carroll, Blindness (Boston: Little, Brown, 1961), p. 113.

[64] Hunter, International Journal for the Education of the Blind, 128.

[65] G. H. Fisher, "Spatial Localization by the Blind," American Journal of Psychology, LXXVII (March, 1964), 14.

[66] Ibid.

In Chapter I it was shown that visualization remains if blindness occurs after from five to seven years. Researchers have found that the adventitiously blinded form patterns about reality mainly from a visual pattern.

Carroll believed that every effort should be made to nurture visual imagery in the adventitiously blinded. He reasoned that by making him aware of how things look, the blinded individual will be more centralized in a seeing world. If he does not use his power of visual memory, he will be living eventually in a visual vacuum. Further, visual awareness is in harmony with his psychological make-up, which is visually oriented due to prior sight. Practically, visualization is of value in orientation and mobility. The aim of educators should be to restore, in as far as possible, the visual patterns of experiencing and reacting to the environment, according to Carroll. Thus, the once sighted, possessing the power of visualization, should be encouraged to use it, preventing atrophy.[67]

Rubin agreed with Carroll that adventitiously blind people form ideas mainly from a visual pattern. In addition, he asserted that the individual born blind forms his ideas in a different way, so that his knowledge of the object world is built up in ways that are essentially different from those of the seeing individual and the later blinded person.[68] Rubin reasoned that a distinction is needed between those born blind and adventitiously blinded in research.

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[67] Carroll, pp. 121-122.

[68] Rubin, p. 12.

Results of a study of abstraction conducted by Rubin pointed out that subjects born blind did less well on tests of abstraction than did the sighted and adventitiously blinded groups.[69] He supported Carroll in the latter's belief that to maintain richness and vividness of imagery, the adventitiously blinded need periodic stimulation.[70]

Critchley placed a great deal of importance on visual imagery. He stated that "vision is biologically so important a special sense that even in those who lose their sight at a relatively early age, a visual type of thinking may continue."[71] Not only did Critchley find that blind persons retain a visual frame of reference, but most blind people probably construct an "image of a visual image," even of faces and scenes they've never seen.[72]

Critchley was in accord with others that the later in life eyesight was lost, the more established is the role of visual associations.[73] Through observation of many patients, Critchley found that

> people who have been blind for many years develop a three-dimensional tactual imagery for objects which are small enough to be "feelable," while larger objects are conceived of in vague visual two-dimensional qualities.[74]

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[69] Ibid., p. 45.

[70] Ibid., p. 43.

[71] M. Critchley, "Tactile Thought, with Special Reference to the Blind," Brain, LXXVI (March, 1953), 27.

[72] Ibid.

[73] Ibid., p. 28.

[74] Ibid., p. 29.

Tactual sense

Many investigators lend support to the thesis that visual memory can aid the later blinded in his educational endeavors. Investigation is needed to find to what extent people born blind can utilize their tactual sense in abstract thinking and, in fact, to find what type of imagery does exist in those blind at birth. Critchley questioned the existence of a purely tactile form of imagery. He theorized that the olfactory and auditory impressions influence imagery. He included in the tactile sense both proprioceptive and exteroceptive sensations and believed the word "haptic" as well as the word "tactual" is appropriate.[75] Critchley relegated importance to tactile thinking. "The importance of tactile thinking in the blind becomes obvious in so far as their own body-image is concerned."[76] He has found that blind children's modeling reveals that body parts which for the moment are important are often exaggerated, and that the body-image of the congenitally blinded or neonate is unusual.[77] To correct misconceptions formed by the child blind at birth, it would seem that continuous experiental opportunity should be offered.

Harley found that children need concrete experiences before abstract thought can develop. Children need "more stimulation from listening, feeling, tasting, and smelling. The implications point to research in adaptation of methods and materials in class-

[75] Ibid., p. 26.
[76] Ibid., p. 28.
[77] Ibid.

room instruction to include stimulation of the blind child through remaining sensory modalities."[78]

Drever concluded from his experiments that the early and those born blind, though imposed with limitations, develop the ability to gain information from their hands more adequately than the sighted.[79] In discussing the blind child, Drever hypothesized that "he should be better at translating pressure and movement into the linguistic categories used in everyday life. That is what he has had to do since he became blind."[80] To draw this conclusion Drever had outlined figures on a pegboard and subjects were asked to tell the relationships and differences.[81]

Blaha found that too often those working with blind people persisted in using mental imagery of the sighted by verbalizing to those without sight. As a result, the blind child can parrot an accurate verbal description of environmental situations, but when asked to function kinesthetically in the same environment, will make inaccurate movements. "This is due to the ambiguity of the child's verbalization which has been made in sighted terms not fully understood by the child."[82] Blaha would resolve this dilemma

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[78] Randall Harley, Verbalism Among Blind Children: An Investigation and Analysis, Research Series, No. 10 (New York: American Foundation for the Blind, 1963), p. 53.

[79] J. Drever, "Early Learning and the Perception of Space," American Journal of Psychology, LXVIII (December, 1955), 612.

[80] Ibid.

[81] Ibid.

[82] Lawrence Blaha et al., "Basic Concepts of Blind Children as They Relate to Problems of Orientation and Mobility," The Long Cane Newsletter, I (1964), 2.

by permitting tactile exploration followed by verbal description and interpretation or vice versa.[83]

Gilson, subscribing to the use of raised maps for blind children, agreed that a verbal description needs to be reinforced and corrected through physical contact. He wrote to the same point as Blaha.

> The child who, through early blindness, does not retain any usable visual memories, possesses an accumulation of unrelated information about his physical environment and has vague and distorted conceptions about the make-up and nature of such everyday things as streets, sidewalks, transportation systems, and topography.[84]

Gibson found that protruberances and surface texture can be perceived tactually, as well as indentations on a plane surface and that this same acuity is taken advantage of in braille.[85] He worked with different sets of shapes devised for object perception by active touch and found that these were mutually distinguishable by feeling and vision, although there was some error and hesitation for the unpracticed observer.[86]

Austin conducted an experiment to determine to what extent various letters, numerals, and geometric forms could be discriminated tactually. Although his investigation did not include blind subjects, he concluded that tactual discrimination is very feasible

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[83] Ibid., p. 4.

[84] Charles Gilson, Daniel Wurzburger, and Daniel Johnson, "The Use of the Raised Map in Teaching Mobility to Blind Children," The New Outlook for the Blind, LIX (February, 1965), p. 59.

[85] J. J. Gibson, "Observations on Active Touch," Psychological Review, LXIX (November, 1962), 484.

[86] Ibid., p. 489.

in situations where visual cues are not readily available or are impossible.[87]

Space perception

The judgment of distance and space is a topic of debate in terms of tactual perception. Senden concluded that tactual perceptions do not result in awareness of space.[88] One who disagreed with this conclusion was Lowenfeld. His statement follows.

> The fact that blind individuals are able to reproduce all kinds of objects, small and large ones, in modeling and handwork, and that they can recognize objects on the basis of previous observations, is evidence that they must be able to unify separate perceptions into one total concept of the object.[89]

Lowenfeld found that the central problem of space perception needs further investigation.[90]

Bailey included the ability to judge distance as a consideration for map-readiness. She believed this readiness can be prepared for by familiarity with the child's own body. By discovering linear differences between body parts, such as the span of the finger joints, legs, etc., the child can find a relatedness necessary prior to map reading.[91]

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[87] T. R. Austin and R. B. Sleight, "Accuracy of Tactual Discrimination of Letters, Numerals and Geometric Forms," Journal of Experimental Psychology, XLIII (March, 1952), 240-245.

[88] M. Senden, Space and Sight (Glencoe, Illinois: The Free Press of Glencoe, Inc., 1960), p. 290.

[89] Lowenfeld, Psychology of Exceptional Children . . ., p. 236.

[90] Ibid.

[91] June Lee Bailey, "Meaningful Maps for the Blind and Seeing," The New Outlook for the Blind, L (March, 1956), 79.

Raised line drawings

Zemtzova has written in the Research Bulletin about his research on embossed designs and some of the work currently being done in Russian schools for the blind. He agreed with his American contemporaries that tactual ability improves through experience. He stated that

> the rearrangement of the central sensory functions in man develops in the course of practical activity and depends upon its contents and conditions. . . . When learning is based on the braille system, stenography, graphical alphabet, the tactual perception becomes improved.[92]

He further found that through using the sensory channels, blind children are able to develop to a higher level than the sighted when the latter use other than sight channels. This is borne out by the use of EEGs which show that a lack of use of those neurons associated with varied senses results in less electrical activity.[93]

The first of Zemtzova's experiments indicated that blind children were capable of interpreting flat geometric figures. These were placed at six different angles of rotation on the drawings, and by the fourth training session blind subjects made a choice of the correct drawing, corresponding to a specified angle of rotation.[94]

Relief drawings as well as geometric designs, are also successfully used in schools for the blind in Russia. Representations such as those used in ink-print two-dimensional drawings

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[92] M. I. Zemtzova, J. A. Kulagin, and L. A. Novikova, "The Use of the Remaining Sensory Channels (Safe Analyzers) in Compensation of Visual Function in Blindness," Research Bulletin, No. 2 (December, 1962), 77.

[93] Ibid., p. 98.

[94] Ibid., p. 86.

are used, but in making relief drawings the specific features of tactual perception are also taken into account.

> Orthogonal projections can be used with the addition of some special notation for relief drawing. Pupils can not only learn to read and reproduce relief designs correctly but can also draw the design of the object themselves or . . . reproduce the object in three dimensions with the use of air-setting plastic material.[95]

The relief drawings used presented some of the qualities of the object essential for tactual perception, especially its shape. Zemtzova reported this more fully.

> Good results were obtained in the course of experimental training of blind children in understanding relief drawings with the help of the method of nonuniform dot covering and perspective change of size. . . . All the surface of the object is represented with relief dots, the density of which is higher the nearer the given segments of the surface are to the person tactilely perceiving the object.[96]

Laws of visual perspective were observed in constructing the drawings. Yet, in explaining this method of representation to the pupils, the laws of vision were not referred to because everything could be understood just on the basis of tactual perception.[97]

Zemtzova concluded that "the use of relief drawings and diagrams show great possibilities of the development of the complex forms of tactual channels in blind children."[98] He recommended more experimental work in this area and pointed to the important role which graphical methods, relief designing, and relief drawings

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[95] Ibid., p. 84.
[96] Ibid., p. 85.
[97] Ibid.
[98] Ibid., p. 86.

are playing as a compensation for blindness in the Russian schools at the present time.[99]

In the United States a more limited amount of research has ensued in this area. Schiff experimented with simple raised line drawings to investigate the practicality of their use with blind children. He reasoned that "as braille functions as a tactile perceptual symbology for language, so must symbolic meaning be found for conveying graphic diagrammatic information to blind persons."[100] He proposed that this information may take the form of maps, figures, cross-sectional diagrams, etc., and that its purpose would be to supplement the written and spoken language. He suggested its usefulness especially in textbooks and believed that at times "diagrammatic information may even transcend the written and spoken word in its economy of communication, or in the specificity of the information communicated."[101]

Schiff's study consisted of the use of tactile arrows to be used in diagrammatic information as a replacement for visually conceived arrows. Rather than the use of raised lines with arrowheads, which may easily be confused with the remainder of a diagram, Schiff incorporated a sharp line to indicate one direction and a smoother line to indicate the opposite direction. Findings

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[99] Ibid., p. 83.

[100] William Schiff, "Research on Raised Line Drawings," The New Outlook for the Blind, LIX (April, 1965), 134.

[101] Ibid.

indicated that training in the use of tactile diagrams is called for. Twenty-four of the 30 subjects preferred the tactile over the visual mode while two had no preference. Because of the over-simplification of the diagrams, it is not yet certain whether this is the most efficient symbol, but Schiff concluded that the symbol is worth further scrutiny.[102]

Morris and Nolan have completed several studies concerning tactile material useful to the blind reader. They have found several areal symbols, linear symbols, and point symbols which are highly discriminable with the tactile senses. They agreed with Schiff that "rehabilitation of the blind requires embossed materials which employ both verbal and graphic forms of communication."[103] They added that while braille is highly developed and standardized, means available for embossed graphic communication, such as maps, graphs, and diagrams are still relatively crude.[104] "Lack of identification of clearly discriminable tactual symbols and lack of knowledge of factors that determine tactual figure-ground relations have seriously impeded development in this area."[105]

Results of the Nolan and Morris research indicated that sets of tactual symbols for areas, lines, and points can easily be remembered. They recommended that those symbols identified in

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[102] Ibid., pp. 135-137.

[103] C. Y. Nolan and June Morris, "Tactual Symbols for the Blind," (unpublished report, American Printing House for the Blind, Louisville, Kentucky, 1963), p. 1.

[104] Ibid.

[105] Ibid.

their study be used in the production of experimental maps, and that they be experimented with in other types of graphic communication.[106]

Summary

Many studies and opinions undertaken in this chapter pertained indirectly to the consideration of embossed drawings to be used in learning movement.

Research was considered which called for a need for a wide scope of methods in education and more specifically, in physical education. Research relating to spatial and object perception indicated that the blind people do not have super-sensory powers but that they can learn to perceive objects tactually.

Certain literature supported the use of graphic information from a tactile perception point of view. This investigator posited that blind children could be trained to identify body positions through the use of embossed drawings. The procedures of the study are described in the following chapter.

CHAPTER III

PROCEDURE

The nature of this study dealt with the problem of training blind children to identify body parts and positions of the body through the medium of embossed drawings.

A series of drawings were prepared and embossed by a procedure described below. These drawings depicted front and side views of the human figure in various postures and sequences. A total of six figures was prepared for a pilot phase of the study.

Eleven children from the Ohio State School for the Blind, ranging from grades five through twelve, served as pilot study subjects. None of these children was selected as subjects for the study. They were given brief orientation periods, after which they were asked to name body parts, body direction, angles of large joints, and positions of the figures. The students encountered varying degrees of difficulty, some readily being able to determine the concepts required of them and others finding difficulty in any kind of identification. Enough success was noted among this group to encourage the investigator. Added to the pilot study was a teacher from the school who was blind from birth. He was able to interpret body parts and relationships as well as actions of the figures with no orientation.

On the basis of this initial limited exploration, it was decided to proceed on a larger scale. The next task was to select and emboss drawings and to determine their appropriate size.

The related literature did not indicate any guidelines to assist the writer in determining size and number of drawings. Thus, decisions regarding selection and numbers of drawings to be used were somewhat arbitrary. Diverse movements and postures used were selected on the basis of level, positions, and direction. Ruth Murray described locomotor movement as falling into the categories of a walk, run, leap, jump, and hop.[1] Elements of these basic movement patterns were incorporated in the drawings. Murray further delineated space patterns to include directions of forward, backward, sideward, upward and downward; levels, involving: elevated, standing, kneeling, sitting, and lying; dimension; path; and focus.[2] As much variety was used as was considered feasible. The writer eliminated some patterns, such as those of twisting that did lend themselves to portrayal on embossed drawings.

Forty drawings were constructed. The number was equally divided among locomotor sequential movements of side and front views, and/or combinations; and static postures of the side and front view.

The drawings were then divided into two equal groups, one of which was to be used for the training of subjects and the other

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[1]Ruth L. Murray, Dance in Elementary Education (2d ed. rev.; New York: Harper and Row, Publishers, 1963), p. 99.

[2]Ibid.

for testing. The following were considered in dividing the drawings for training and testing: similarity and degree of difficulty of the drawings, as well as an equal division of sequential front views, sequential side views, sequential combinations, static front views, and static side views. The 20 test drawings consisted of 51 figures, while there were 48 figures in the 20 training drawings.

The drawings were submitted to a total of three physical educators who were specialists in body mechanics, gymnastics, and basic movement. These physical educators were asked to make a judgment of the drawings as to the following: (1) accuracy in representing body parts, and (2) clarity in depicting the body position. The drawings were scored on a pass-fail basis. A sample of the scoresheet may be found in Appendix C. The incorrect features were noted for all drawings that failed in any category. Any drawing which was considered inadequate by two judges was redesigned. Two drawings--the forward roll and the broad jump--were redesigned as a result of this procedure.

Ink replicas of the embossed drawings were presented to two sighted boys and two sighted girls in the third and fourth grades at the University School of The Ohio State University. Their responses were tape recorded and later analyzed and compared to those of the blind subjects of the pilot study group. Sighted third and fourth grade students were selected because it was believed that their level of verbalization would be comparable to that of the lowest grade level of blind students utilized in the study. It was assumed that if a child this young had no difficulty

in understanding the intent of the movements portrayed in the pictures, then the pictures would be sufficiently accurate to emboss. A second purpose was to determine the nature of the vocabulary of seeing children in their explanations. After listening to the tapes and comparing them to responses of the blind subjects, it was found that verbal descriptions were similar. The seeing children had no difficulty in interpreting and verbalizing about the drawings.

Size of drawings needed to be decided prior to selecting the drawings for this study. Three sizes of identical embossed figures were designed by the investigator and were presented to all children who were to be subjects. The various heights of the figures were five inches, seven inches, and ten inches. Drawings were presented to subjects in a rotational order to minimize the tendency to select the middle-sized figures. This allowed for six different orders of presentation. After the subjects had palpated the drawings, they were asked the following questions:

1. From which size drawing do you think you could best learn movement skills?

2. From which size drawing do you think it would be most difficult to learn movement skills?

Of the 24 subjects asked the first question, seven preferred the small size, nine preferred the middle size, and eight preferred the large size. These results were inconclusive. In answering the second question, twelve subjects least preferred the small drawings, two the middle-sized drawings, and ten the large-sized drawings. These results were interpreted as supporting the choice of the

middle-sized drawings. On this basis the middle-sized drawings were incorporated in this study.

The group of subjects used in the pilot study had found the thickness of the embossed drawings sufficiently distinct. The thickness used was found to be comparable to that of Braille books. One layer of poster board was used for the design of the body. Other layers were added where depth perspective was needed.

The method of embossing was a relatively new process. This method utilized vacuum heat produced by a Thermoform machine. The figures were constructed of cardboard and mounted on paper, with those body parts nearest the observer being of the greatest density. A plastic sheet, called Brailon, was placed on the drawing, and this was then heated in the machine. The heat melted the plastic resulting in an embossed surface on the plastic sheet. Any number of copies can be duplicated by this method at a nominal cost. The sheets retain their embossed property even if they are maintained in book form.

Several criteria were used in selecting subjects for the study. Subjects chosen were blind at birth or in infancy.* It was decided that the effect of possible visual memory should be eliminated from the study. Rubin supports this when he concludes that

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*One boy in the eighth grade, who had had some sight in one eye until the age of ten, was inadvertently included in the training phase of the study. Although the results of his testing were not included in the data, he was tested as a pilot phase to the testing. A transcription of his responses to both the training drawings and the testing drawings, along with photographs of the drawings used in the study, may be found in Appendix A.

all too often studies include those blind at birth and accidentally blinded subjects, without accounting for differences between the two in terms of visual memory.[3] The factor of visual memory led the investigator to select eighth grade girls because every girl in that grade was totally blind from birth. This provided a sizeable group of subjects at one grade level.

Subjects selected had a minimum intelligence quotient of 90. This intelligence quotient was considered normal for blind children tested on The Interim Hayes-Binet Scale.

After examining medical records and using the above criteria, the investigator eliminated certain grade levels because in some cases, only one and in other instances no one in those grades qualified in all categories. It was decided on the basis of the Morris and Nolan study, not to go below the fourth grade to select subjects. Their finding that "children's ability to make tactual discriminations does not fully develop until they are in the fourth grade"[4] influenced the decision to select subjects from above the fourth grade.

Students selected were from the following grades: three boys and two girls from the fifth grade, two boys and two girls from the seventh grade, and six boys and eight girls from the eighth grade. Two other boys in the seventh and eighth grades

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[3]Edmund J. Rubin, Abstract Functioning in the Blind (New York: American Foundation for the Blind, Research Series, No. II, 1964), p. 18.

[4]June E. Morris and C. Y. Nolan, "Discriminability of Tactual Patterns," International Journal of Education for the Blind, XI (November, 1961), 50-54.

decided against participating in the study after they had been selected.

Permission slips to participate were sent to subjects' parents. A sample of this along with a cover letter may be found in Appendix D. After confirmation from parents, training procedures were initiated.

Training Procedure

Suggestions by various writers guided the examiner in selecting the training procedures. Methods of using the fingers most effectively to read the drawings were derived from the literature and from those methods utilized in reading braille.

The subjects were encouraged to use both index fingers in scanning the drawings. Some also used the second fingers. The index and second fingers are usually preferred and show finer acuity. Throughout the training phase, subjects were advised to palpate the drawings with a minimum of pressure and extraneous movements. They were asked to scan a whole figure before attempting to find various body parts and their attitudes. This was done in hopes of assessing the total position and to assure the locating of all body parts prior to interpreting them. It was observed that those subjects who had difficulty in learning to read the drawings manifested many of those undesirable characteristics cited in the literature.

French and Morgan supplied information to aid in implementing better reading skills. They stated that "the fatigue rate of touch is high. Relatively short periods of close attention--

finger reading, for instance--produce a dimming of perception comparable to blurred vision."[5] They also stressed that success in touch depends to a great extent upon the condition of the skin. They wrote that "perspiration, dust, callouses, or numbing cold can be as deadly as any eye cataract."[6]

To reduce static electricity of the plastic sheets, subjects moistened fingers occasionally on a sponge soaked with water and detergent. This was done in accordance with a suggestion by the firm producing the Brailon sheets. Some subjects found that their fingers slid more easily on the sheets using this mixture while others found it irritating and drying to their fingers and did not care for its consistency. No subject was forced to use this aid.

Subjects were seen individually during their physical education periods, after school and in the evenings at their cottages. No time limit was set in terms of their learning the training drawings. Since the purpose of the study was to determine if they could learn to read and interpret embossed drawings, it was believed that individual differences should be taken into account, just as they are when sighted children learn to read. Time spent with subjects during physical education periods consumed no more than 15 minutes per session. Sessions at the cottages ranged from 15 minutes to 45 minutes, with most running around a

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[5]Richard A. French and David H. Morgan, "Aids in Education and Recreation," What of the Blind?, ed. Helga Lende (New York: American Foundation for the Blind, 1941), p. 9.

[6]Ibid., p. 7.

half hour. Total training time for subjects varied. The most time spent with any subject in training was six hours and the least was two hours. The majority of subjects spent two to three hours to learn to read the embossed drawings.

In addition to coaching toward the use of at least two fingers of each hand to read the drawings, subjects were encouraged to use one hand on either side of the body simultaneously as they first scanned the figure. Just as they were taught to read braille with horizontal movements of the fingers, they were taught to read the drawings with straight movements in the direction of the outline. They were asked not to move back and forth across a line but to follow it to its extremity.

The first task in the training phase was to become familiar with body parts as they were symbolized in the figures. It was surprising to the investigator that some subjects could not name all the body parts involving joints. One subject could not identify his own ankle joint. Others confused the locale of the hips and waist on their own bodies. As a result of these and other deficiencies concerning the human body, orientation regarding the names and nature of joint angles had to precede and accompany work with the drawings.

Direction of the head was determined in part by placement of the nose. Subjects learned that if the head faced front the nose would be at the center of the head, whereas if the head were a profile, the nose could be located on the side of the head.

Two shoulder joints further indicated that a figure was facing front. On a side figure the shoulder was raised on the

paper to appear closer to the observer. Recognizing its position could also help the subject determine its attitude.

Subjects were told to look for a projection depicting the seat, further indicating that the body was a sideview. They were helped to decide if knees and elbows in a sideview figure were straight by a slight projection of the joints and by angles of the limbs to varying degrees if the parts were bent. The leg and arm, as seen from the front, would show a slight indentation at the knee or elbow joints to distinguish upper and lower extremities.

Subjects were taught that if they could not find the thumbs of the hands they would be observing the small finger side of the hand. The sideview of a foot could be identified by locating the toes and heel, whereas the frontview would show an ankle joint as well as a projection of the toes below the floorline, unless the figure was on his toes at the floorline or in an aerial position above the floorline.

After body parts were defined and recognized by subjects, concentration was on position. The floorline was used as a reference point to help in identification as subjects related feet, hands, or other body parts to it. Subjects were asked to determine whether body parts were near or far from the body, to describe the angles of such joints as hips, waist, knees, etc., in relation to each other.

Differentiation of right and left limbs was one of the most difficult concept for subjects to comprehend during training. Several factors seemed to confuse them, one of which was the

problem of mirror imagery. Most subjects had never considered that another person facing them presented a right hand on the opposite side of the body to their own right side. Once this concept was understood, the problem was somewhat resolved. Further confusion resulted in understanding right and left limbs on a sideview figure. Some of the drawings did not show conspicuous differences in the height of limbs closest to the subject, particularly the legs, and some subjects commented that the leg nearest them did not really feel much more raised off the paper than the other.

Another point of reference which helped subjects determine right and left limbs was the intersection of the outline of one limb across another which was caused by varying angles of the limbs. Subjects were aided in determining a right arm, providing a figure was in the direction that his right side was to the observer, by following the arm from the shoulder joint to the fingers. This could also be accomplished with the leg by starting at the hip joint.

It was late in the training phase that most subjects understood a sideview. Quite naturally, they would conceive of themselves from the front, and how one appears from a side perspective needed to be carefully interpreted. One boy, a member of the track team, accurately verbalized the positions of right and left legs and arms and relations of body parts to each other, but was unable to realize that the sequence depicted a run. After finding that the figure was running, he stated: "But my legs are always in

front of me when I run." A few subjects preferred to place the drawing on a wall and face the same direction themselves while they were scrutinizing and verbalizing about the stance or movement involved. After a considerable amount of training in the realm of laterality, subjects were able to recognize movement from this aspect. Realizing that for the blind subjects the drawings were symbols of human movement, just as braille is a symbol of the spoken word, one would expect greater insight with training.

To distinguish a sequential drawing which did not express movement from one place to another from one which did, a triangle was embossed on the lower left corner of all drawings relating to movement through space. Subjects readily learned to recognize and to understand the meaning of the triangle.

The presentation of drawings was rotated during training and testing sessions to eliminate anticipation of subjects to any particular aspect of a drawing. Thus, from the categories of: static front, static side, sequential front, sequential side, and sequential combination, the drawings were systematically rotated.

Throughout the training procedure, subjects were asked to verbalize about the training points emphasized. If they faltered or erred they were given assistance, and at a later time they were presented the same figure. Where feasible they were asked to assume the postures they were describing. Initially there were inaccuracies in the distance of legs and arms from each other, but these were minimized after subjects assumed the positions and began to transfer distances in the figures to their own position.

Testing Procedure

To determine subject retention, initially both training and testing drawings were to be included in the final testing. After testing Subject "A", who was highly competent in ability to interpret and to verbalize about the drawings, it was decided to eliminate training drawings from the testing of the remaining subjects. Subject "A" utilized 45 minutes of tape time to test the full complement of 40 drawings, and it was believed that other subjects, less proficient, would operate at a slower rate, rendering the total time for 22 subjects an impracticability for the judges. On this basis it was decided to test using only drawings previously unseen by subjects.

Subjects were tested when it was deemed by the investigator that they were ready. Each subject perused all training drawings until he could understand and interpret them with reasonable accuracy. Drawings were seldom scanned more than once. However, four subjects needed additional review. These subjects were tested without having all points of confusion clarified, because it was concluded that further tutoring would not result in better understanding of the concepts involved. During the last training session subjects were tape recorded to allow them to become familiar with and accustomed to the microphone.

Testing sessions generally lasted two hours. These sessions were divided into one-hour periods with an hour break to prevent fatigue. The recorder pause button was used during periods of silence and while subjects initially examined the drawings in order

to keep the tape time at a minimum. Subjects were allowed to scan the figure for one minute before responding. No subject utilized a full minute to do this. Questions asked of subjects were open-ended in nature. Thus, tape time varied as verbalization ability differed among subjects. Tape time ranged from 20 minutes to 55 minutes, with most tapes running for about 30 minutes. Subjects were allowed to stretch or walk around between their discussion of drawings if they showed signs of fatigue.

All subjects were given the following statement prior to their testing:

> Before talking about a drawing you will have one minute to look at it. Look at the whole body before describing it. Do not guess. After I announce your name, grade, age and the number of the drawing, you may begin to describe what you see. I will state the number of each drawing before you describe it. You should include each of the following points in your description: the relation of the body to the floor, positions of the arms and legs, whether the figure is facing you or has his side to you, whether you are looking at the right or left legs or arms, whether the legs and arms are in front of or behind the body or to the side of it, and any other information you may find. If you notice that the figure is doing a specific stunt you may name it if you want to. If you do not include information in your description, I will ask you questions about the figure. You may tap me if you want the tape stopped to try the movement if you think it would help.

It was also explained to subjects that this test was not like those they take in school, in that they were not being tested, but the drawings were being tested to determine if they might be used as a way of learning movement skills. Even so, a few subjects appeared nervous or apprehensive over a testing situation and using a microphone.

Subjects were tested within the week during which they had completed their training. Testing took approximately two months to complete.

Assessment Procedure

Five judges, all physical educators from The Ohio State University, were selected on the basis of their special skills. One was a physical therapist who taught body mechanics. One had children slightly younger than the youngest subjects used in the study, and it was believed that she would have a certain depth of understanding regarding children's vocabulary. One was a gymnast who was acutely aware of movement analysis. The fourth was a specialist in adaptive physical education and the fifth taught synchronized swimming, which like gymnastics, involves concentration on movement analysis. By using five judges, it was hoped that consistency and objectivity would increase.

Scoring

Ten subjects' statements were transcribed regarding the same figure after all subjects had been tested. Subjects were not identified. The judges, who met as a group to attempt to attain consistency in scoring, rated these ten descriptions on a one to seven rating scale. After reading the descriptions while looking at the drawing being described, the judges recorded the scores on a score sheet which was the same as that used in the actual study. The score sheet, which may be located in Appendix E, provides space for stating the reasons for a score below seven. No standards were

set by the examiner to determine a specific score, as it was decided that implementing standards might introduce the personal bias of the examiner. After the judges scored all ten subjects, they compared and discussed their scores. Differences of more than one point among judges occurred in four of the ten items. Reasons for differences were discussed by judges in an attempt to attain consistency in scoring.

Scott and French advocated the use of several categories on a rating scale when discrimination between small differences is called for, but they believed that the use of more than seven categories becomes too time-consuming and requires a high degree of discrimination.[7] Best confirmed the use of up to a seven-point scale.[8]

Each judge was given a set of score sheets at their meeting during which the attached directions were reviewed and discussed. A sample of these instructions is included with the score sheet in Appendix E.

Judges were asked to limit themselves to one session in any one day to decrease the fatigue factor and to maintain some amount of continuity in the scoring situation. There were six sessions, each consisting of approximately two hours. Judges were allowed to listen to and judge the tape recordings in their homes. It was requested that they finish judging a subject at one sitting,

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[7] M. Gladys Scott and Esther French, Measurement and Evaluation in Physical Education (Dubuque: Wm. C. Brown Publishers, 1959), p. 403.

[8] John W. Best, Research in Education (Englewood Cliffs, New Jersey: Prentice-Hall, Inc., 1959), p. 164.

but time could be taken between subjects. They were asked to finish within two weeks at the most, to allow time for the two sets of tape to circulate. They were not to refer back to previous score sheets because by so doing, comparisons might be made with other subjects. Judges were told that they could rewind the tape to listen again to a response only if they did not understand the subject's comment. Finally, they were asked to conduct scoring sessions under the most ideal conditions for good concentration.

The judges' procedure during testing was that of listening to a subject's response to a drawing while viewing the drawing. In addition, the drawing could be studied prior to the subjects' recital. The judge could then repress the pause button on the tape recorder while he recorded the score on his score sheet and stated reasons for a score below seven. Suggested possibilities for reasons were coded for expediency and may be noted on the right side of the score sheet which is in the Appendix.

Summary

Preliminary steps to collecting data included finding a method of embossing drawings determining the best size figure to utilize with the blind children.

Subjects entered a period of training, and after they understood all concepts involved, they were individually tested. Testing was conducted by tape recording subjects' verbal impressions of the drawings.

When the testing was completed, the selected judges scored the taped subject responses. The judges' score sheets were analyzed. The following chapter deals with the analysis of the study.

CHAPTER IV

ANALYSIS OF THE DATA

The primary purpose of the study was to determine the possibility of the use of embossed drawings of human figures representative of movement sequences and static positions as a teaching tool for blind children. A second purpose was to determine methods of orientation needed to facilitate the use of embossed drawings by blind children.

The primary question under investigation was: Can blind children learn to read and interpret embossed drawings of human figures as they represent positions found in selected motor skills? To further probe this problem other questions were structured. These questions were:

(1) What is the nature of faults which occur in recognizing and describing various body parts as they are represented on embossed drawings?

(2) What types of errors occur in determining the direction of the human body in terms of a front or side view, as depicted on embossed drawings?

(3) What types of errors occur when distinguishing the right and left body parts of figures on embossed drawings?

(4) What types of errors are presented when blind children determine the relationship of the body and body parts to the floor or baseline?

(5) What is the nature of faults in recognizing positional differences of limbs?

Table 1 shows how the judges scored subject performance on each figure. These scores represent the combined averages of the five judges' scores. The cumulative averages of the five judges on all figures was 6.30. The range was 1.00 with the high score being 6.85 and the low score 5.85. Based on a seven-point scale, these scores indicate that blind children can read and interpret embossed drawings of human figures as they represent positions found in selected motor skills.

The seven highest scores were for figures depicting standing postures. The fourth and sixth figures down from the highest score represented side views, while the remainder of these seven figures were front view positions. Points were deducted from the seven figures on the basis of such problems as the relation of arms to the body, that is, one being further from the body than the other; the angle of the head which may have been slightly tilted; or a slight shift of weight.

Also recorded on Table 1 are the mean scores of drawings. The average scores on various types of drawings were: sequential combinations, 6.42; sequential front, 6.32; static side, 6.30; static front, 6.19; and sequential side, 6.18. The range of these scores was .24. It appears that there was not an appreciable difference in subject ability to interpret various categories of drawings. Sequential side views were essentially as easy to interpret as sequential combinations.

TABLE 1

MEAN SCORES OF FIGURES AND DRAWINGS

Drawing Number	Mean Scores of Figures	Mean Scores of Drawings	Drawing Number	Mean Scores of Figures	Mean Scores of Drawings
6	6.36	6.36	C	6.65	
7	6.08	6.08	D	6.85	
8A	6.20	6.14	27A	5.92	6.19
B	6.35		B	6.17	
C	5.88		C	6.05	
9A	6.11	6.22	D	6.65	
B	6.11		28A	6.32	6.22
C	6.45		B	5.93	
10A	6.40	6.31	C	6.12	
B	5.85		D	6.54	
C	6.68		29	6.17	6.17
16	6.12	6.12	30	6.32	6.32
17A	6.25	6.43	36A	6.34	6.18
B	6.12		B	6.03	
C	6.48		C	6.22	
D	6.50		D	6.15	
E	6.78		37A	6.10	6.44
18A	5.97	6.13	B	6.42	
B	6.06		C	6.81	
C	6.37		38	5.95	5.95
19A	6.73	6.72	39	6.69	6.69
B	6.68		40A	6.71	6.25
C	6.77		B	6.13	
20	6.28	6.28	C	6.13	
26A	6.75	6.60	D	6.03	
B	6.15				

When the average scores of individual figures were grouped by drawings and the drawings were arranged in descending order of scores, there was no pattern in the location of the various type drawings. A sequential combination drawing (Drawing 19) depicting a half jump turn scored highest, and a static front view (Drawing 38) scored lowest. This drawing portrayed the figure with his arms

extended straight from his shoulders and the body was tilted slightly to the left. Most subjects failed to mention the body tilt.

Table 2 summarizes the types of subject errors. The five judges rated the 22 subjects on 51 figures. If each judge were to note one fault in every figure, the number of judgments would mount to 5,610. If each judge were to find five or more faults on a figure, this would considerably raise error possibilities. There was a total of only 2,780 errors on subject responses. Some judgments were concerned with omissions rather than errors. The low number of total judgments further substantiates the conclusion that blind children, after training, are able to read and interpret the embossed drawings. Table 2 provides answers to the next five questions.

The first of these questions was: What is the nature of faults which occur in recognizing and describing various body parts as they are represented on embossed drawings? There were just 72 errors to identify recognition as a problem. Particular faults were confusion of knees and elbows when they were placed in close proximity to each other, and in the instance of Drawing 27, confusion of the head and seat.

The second question to be answered was: What types of errors occur in determining the direction of the human body in terms of a front or side view, as depicted on embossed drawings? The 132 errors about this aspect reflected a minor problem in this relationship. Subjects were, for the most part, able to determine the direction of the body. Most confusion occurred when the figure

was in other than a vertical position. One drawing, in which the figure was lying on his back, created a problem with a few subjects who said, "He's lying on his side." Some explained after the tape was turned off that they had meant that they were looking at his side. The results suggest that subjects basically had very little trouble with body direction.

TABLE 2

SUMMARY OF SUBJECT ERRORS

	Judge 1	Judge 2	Judge 3	Judge 4	Judge 5	Totals
Angle of body joints	106	77	745	39	95	1062
Relation of limbs, hands and feet to each other	57	55	636	15	43	806
Identification of right and left hands or arms and feet or legs	51	34	43	53	60	241
Direction of the body side or front view	18	9	11	26	68	132
Identification of body parts	15	13	12	5	27	72
Relation of body or body parts to the baseline	41	29	33	45	34	182
Angle of body forward or backward	52	47	40	11	40	190
Gross body position	48	13	22	3	9	95
Totals	388	277	1542	197	376	2780

The third question was: What types of errors occur when distinguishing the right and left body parts of figures on embossed

drawings? There were 241 judgments which verified that there was little confusion in this area. Suggested was the element of mirror imagery which may have led to some of the problems with right-left identification. After training most children were able to resolve this difficulty. The majority of those who found this identification problematic had difficulty distinguishing right and left limbs on side view figures. Especially correct identification of legs was perplexing to a few subjects. Out of the numerous possibility of errors, a negligible number of judgments were noted, and it may be concluded that blind children are able to discriminate right and left body parts.

The fourth question asked: What types of errors are presented when blind children determine the relationship of the body and body parts to the floor or baseline? There were 182 indications that children misinterpreted in coping with this problem. Judges' comments focused upon distance of body parts from the baseline and angles of the body in relation to the baseline. Distances were a problem for children to describe.

On front standing positions, some children stated that feet were below the floor. The concept of perspective as it affected a representation had to be interpreted to those children during their training phase.

Although most subjects described an aerial figure correctly as being a foot or two off the floor, some regarded the drawing literally by stating that the figure was an inch off the baseline. Some subjects did not indicate the direction of body parts as they

related to the floor. Subjects had some difficulty in being verbally specific about the angle of body parts to the floor. The total number of faults indicates that the blind children tested in this study had very minor problems in the ability to establish the relationship of body parts to the baseline.

The last question presented was: What is the nature of faults in recognizing positional differences of limbs? This appeared to be the most serious problem, according to the 1,062 faults recorded by judges. Subjects neglected to mention or misinterpreted positions of hands and arms. Other misconceptions revolved around errors regarding the degree of angle of limbs. If there were a difference in flexion of limbs, subjects often did not remark about the variation, and they omitted mention of positional differences in their relation to the body.

Defining angles of the body presented a more serious problem. Many children were unable to detect differences in body lean from one figure to another in the same sequence. This confusion was evidenced by judgments made under the headings on the score sheet of Gross Body Position and Angles of the Body. A total of 285 judgments were scored about these features of the figures. From experience and observation during training, the investigator considered the inability to discern the degree of verticality a rather serious problem which would necessitate careful consideration in finding means of correction.

Although a greater number of errors and omissions were noted concerning positional differences of limbs, subjects were

able to interpret these satisfactorily. Relating to a possible number of judgments, it may be concluded that the blind subjects used in this study were cognizant of positional differences.

Table 3 summarizes the scores of individual subjects. As in Table 1, this was an average of the five judges' scores. Table 4 further delineates information about subjects, relating their intelligence quotients, grades, and average scores.

TABLE 3

MEAN SCORES OF SUBJECTS IN RANK ORDER

Subject	Mean Score	Subject	Mean Score	Subject	Mean Score
U	6.63	W	6.53	V	6.18
R	6.62	P	6.51	L	6.07
T	6.61	C	6.51	E	6.04
S	6.60	I	6.41	J	5.93
O	6.60	H	6.41	B	5.84
N	6.55	K	6.36	G	5.75
Q	6.54	F	6.31	D	5.71
				M	5.69

The mean scores of the 23 subjects was 6.29. The high score was 6.63, held by Subject "U", a boy in the fifth grade. The low score was 5.69. This score was that of Subject "M", a boy in the eighth grade. Three of the four subjects who scored highest were in the fifth grade. The range of the averages of subject scores was .94.

TABLE 4

SUBJECT SCORES AND INTELLIGENCE QUOTIENTS BY GRADE AND SEX

Boys			Girls		
Subject	I.Q.	Average Score	Subject	I.Q.	Average Score
		Grade V			
E	106	6.04	D	92	5.71
R	92	6.62	S	113	6.60
U	90	6.63			
		Grade VII			
B	118	5.84	P	92	6.51
O	105	6.60	W	97	6.53
		Grade VIII			
C	132	6.51	H	106	6.41
F	104	6.31	I	104	6.41
G	97	5.75	J	106	5.93
M	106	5.69	K	104	6.36
V	121	6.18	L	146	6.07
			N	94	6.55
			Q	96	6.54
			T	116	6.61

The I.Q.'s of subjects ranged from 90 to 146 with a mean I.Q. of 106 for the 22 subjects. The mean I.Q. for the 10 boys was 107 and for the 12 girls, 105.

There was a very slight difference between boys and girls in average scores, the average scores being 6.21 for the 10 boys and 6.35 for the 12 girls. Boys in the fifth grade obtained an average score of 6.43 on the drawings while girls in that grade were at 6.15. The total average for the fifth grade was 6.32. At the seventh and eighth grade levels, girls achieved slightly higher

scores than boys. In the seventh grade, average scores were as follows: boys, 6.22; girls, 6.52; total average scores of boys and girls, 6.37. Eighth grade scores were: boys, 6.08; girls, 6.36; with a total average of boys and girls, 6.25. The eighth and fifth grades were slightly lower than the seventh, and the eighth grade was slightly below the fifth grade. No significance can be attached to an analysis of the scores by grade, I.Q., or sex because of the few subjects at the fifth and seventh grade levels compared with the numbers in the eighth grade and because of the very small range in mean scores of subjects.

In the ensuing discussion concerning major faults of subjects in interpreting figures and during the discussion of omissions and errors of individual drawings, which may be found in Appendix B, the word "judgment" was used to indicate the numbers of tallies marked for a particular fault. Each judgment did not necessarily represent a score value of one point. Therefore, to prevent confusion, the word "score" is not alluded to during the discussion of subject faults. Judges were asked to record reasons for below a seven on a one to seven scale. There may have been any number of reasons for arriving at a particular score.

There were several reasons for subjects omitting or making errors about body joints. The investigator neglected to train for minor differences in angles of the head, arms, legs, or body. She did not elicit statements from subjects either during training or testing about positions or directions of feet and hands because the focus was toward determining gross body positions and defining

generalities in terms of the body and the body parts. Further, some of the drawings had such subtle angles that in the process of accepting the drawings and concentrating on descriptions about the totality of the figures' postures, the investigator overlooked these. During training, the investigator was surprised that many subjects mentioned slight angles as well as differences in angles in succeeding figures of a sequence. By placing emphasis on the major aspects of the figure, minor changes were not exploited. An example was Drawing 16, which represented a squat thrust with arms extended in front of the figure. The head was tilted back. The largest number of judgments was made about this figure because subjects failed to mention that the head was at an angle.

Whether subjects could discern these variations in body angles would need to be determined in another study as the investigator neither trained nor tested in hopes of seeking finer points of body variations.

Many of the judgments concerning the relations of limbs to each other had the same basis for deductions as those found in describing joint angles. For example, in some of the standing figures, one arm was slightly further from the body than the other. The examiner neither asked for nor received responses with this fine a discrepancy. Other judgments about limbs had to do with slight changes in their positions from one figure to another in sequential drawings.

During a sequence, if a later figure was depicted in the same action as an earlier one, subjects were encouraged to say the figure was doing the same thing rather than belaboring a like

description. This was done to save tape time. However, in some cases, even though the figure was taking the same stance, its position was not precisely the same. Such a drawing was Drawing 9, where the right thigh in Figure C was slightly different from Figure A, and judges deducted because of this difference.

Another predominant error was that of misinterpreting total body angles. This was especially evident in Drawing 40 which depicted the progressive movements of a heel click, and Drawing 38, which described a lean to the left from the hips up. Several subjects had difficulty in recognizing slight deviations from the vertical position.

Right and left discrimination may be noted as a problem in Table 2. Usually it occurred in side view drawings or in those where the body was in something other than a vertical position. Legs were more difficult in this respect than were arms. The latter did not have as much limen on the embossed drawings. There were just a few subjects who erred consistently in these relationships.

When hands and feet were close to each other, and especially from a side view, were similar in shape, a few subjects confused the hands and feet.

With major errors of all drawings having been indicated, the reader is referred to Appendix A, which contains photographs of the drawings, to better clarify the nature of subject errors, and to Appendix B, which shows the types of errors for each drawing.

Judges were consistent in their scoring. For the 51 figures of 22 subjects, there was a six-point range of score values among

the five judges in rating one figure, a five-point range in six figures, a four-point range on 30 figures, and a three-point range on 120 figures. Other than that, there was no more than a one- or two-point deviation with the majority of the scores deviating no more than one point. Many figures showed complete score agreement among judges.

The total score average seemed to indicate that judges believed subjects could adequately describe the drawings. Numerous reasons for arriving at a particular score were stated. These faults did not necessarily decrease the value of a score by a whole point.

Judges differed in their reasons for arriving at a score. What one considered an error or omission, another did not regard as vital to subject understanding. However, each was consistent in his own reasons for deducting points. Table 2 shows primary faults recorded by judges about the subject responses.

The numbers of judgments made by Judges 1 and 5 were similar to each other, even though each varied in the nature of deductions. As may be noted on Table 2, Judge 3 consistently made judgments throughout the responses regarding angles of body joints. She found 745 errors in respect to angles, mostly concerning those of subject neglect to mention direction of the palms of the hands. Judge 1 tended to agree with Judge 3 with 106 judgments indicating a problem, but her comments were directed toward errors of larger body joints such as degree of knee bend or lack of tilt of the head

or hips. Judge 2 cited 77 errors about angles with reasons for these judgments being similar to those of Judge 1.

Other prominent areas of omissions or errors, as indicated by judges, were in the ability of subjects to relate body parts to each other and angle of body parts to the baseline.

Judge 4 found 53 subject errors in the identification of right and left hands, feet, legs, or arms. Judge 5 stated 95 times that responses were in error concerning angles of body joints.

Summary

The investigator compared average scores of subjects and averages of judges' evaluations of drawings to determine the level at which subjects performed in reading and interpreting embossed drawings representing human movement. Tables summarized subject performance on drawings as well as average scores on each drawing.

Meaningful indicators of subject performance were the judgments made about subject errors or omissions during their tape recorded responses to the drawings. Responses were evaluated on a one- to seven-point rating scale with seven being the highest possible score. Judges were asked to cite reasons if a score to a response was below seven.

The mean score of all figures was 6.30, with the high score being 6.85 and the low score 5.85. The subject mean score was 6.29. The highest average made was 6.63 while the lowest was 5.69. These scores appeared to indicate that the subjects were able to adequately read and interpret embossed drawings of human figures depicting movement.

When a judge commented on an error, he did not necessarily reduce the score by a full point value for that error. More than one error may have comprised a reduction of a point. Several hundred judgments were made as shown on Table 2, but it appears that judges evaluated them as minor in terms of score values assigned to the drawings.

CHAPTER V

SUMMARY AND CONCLUSIONS

The primary purpose of the study was to investigate the possibility of the use of embossed figures representing movement sequences and static positions as a teaching tool for blind children. A second purpose was to determine methods of orientation needed to facilitate the use of embossed drawings by blind children.

To realize this purpose, drawings were presented and subjects were asked to locate body parts and to describe their attitudes as well as to define relationships of one body part to another and to the baseline. After a period of training, subjects were tested. To accomplish this, their responses were tape-recorded and judged on a subjective basis.

Chapter II, which reviewed the literature, seemed to lend enough support to merit further attention toward investigating the use of embossed drawings as a tool for blind children in learning motor skills. Some of the universal problems found in obtaining matched pairs and controlling the many variables found in research with blind people were presented. A sophisticated statistical analysis of data was judged to be meaningless for the following reasons: a sufficient number of subjects for matched pairs was

not available and significant variables were uncontrollable due to the small number of subjects.

The procedures used to analyze the data were a comparison of means of subjects, a comparison of combined means of all judges on the drawings, and an interpretation of the reasons for errors as cited by judges.

Twenty-two boys and girls were chosen from the fifth, seventh, and eighth grades from The Ohio State School for the Blind. Subjects were selected who were blind at birth or in infancy to eliminate the possibility of visual memory. Another important requisite was a minimum intelligence quotient of 90 to ensure educability of the subject. No child with physical disabilities other than blindness was selected, and all subjects had had experience in reading braille.

Five judges, physical educators at The Ohio State University, were selected on the basis of their professional specialties. After subjects were tested, judges met and conferred about meanings of particular scores. The examiner did not interject standards of scoring because of: (1) the liability of introducing personal bias, (2) the purpose of having judges was to gain unbiased subjective opinion of the nature of the errors made by the subjects, and (3) it was deemed necessary to ascertain the types of subject errors before a further study could provide judges with a scale to rate the ability of blind children to read the embossed drawings.

The tape-recorded responses were judged on a one to seven rating scale by the five specialists with a seven being the highest possible score. Mean scores of all judges on subject performance

were computed. Relatively high mean scores were found. The mean score of the subjects was 6.29 with a range from 5.69 to 6.63. Combined average scores of judges on figures and drawings were similar to subject scores. The drawing ranking the highest was Drawing 19 with a score of 6.72, while the lowest score obtained was on Drawing 38 with a score of 5.95. The average scores of the judges on figures was 6.30.

Judges were very consistent in their numerical scores. In most cases there was only a one- or two-point range, and in a number of scores judges were in agreement. Scores showed a six-point range in just one figure.

Means of arriving at score values varied among judges. There were 1,062 judgments concerning either error or omission in subject response to angles depicted on body joints. Though one judge noted many errors related to direction or angle of hands, other judges did not consider this a major problem. Larger joint angle errors such as the knee or elbow were more frequently held as being a major problem in the category of joint angles.

Other major subject errors were in the areas of identification of right and left hands, feet, legs, or arms and misinterpretation or omission of the relation of the body parts to the baseline.

The primary question under investigation was: Can blind children learn to read and interpret embossed drawings of human figures as they represent positions found in selected motor skills?

Subject scores and scores on drawings were well above the mean of four on a one to seven rating scale. The subjects tested were able to read and interpret the embossed drawings.

To further describe difficulties encountered by subjects, other problems were explored. Pertinent to the assessment of reading ability was a consideration of the faults evidenced in the subjects' interpretations. The results of the assessment of reading faults suggested answers to the questions which follow.

1. What is the nature of faults which occur in recognizing and describing various body parts as they are represented on embossed drawings?

2. What types of errors occur in determining the direction of the human body in terms of a front view or side view, as depicted on embossed drawings?

3. What types of errors occur when distinguishing the right and left body parts of figures on embossed drawings?

4. What types of errors are presented when blind children determine the relationship of the body and body parts to the floor or baseline?

5. What is the nature of faults in recognizing positional differences of limbs?

According to the score values assigned to the subjects' responses to the drawings, blind children can adequately read and interpret embossed drawings of human figures depicting motor skills. Table 2 in Chapter IV indicates the nature of subject faults. A total of 2,780 judgments indicate that errors and omissions did not

seriously hamper subjects' ability to interpret the drawings. The greatest number of errors was found in discussion of angles of body joints.

Certain restructuring of the drawings and improvement of methods of training might enhance subject efficiency. A horizontal line symbolized the baseline and perhaps a line needs to be drawn at a 90^{o} angle to the baseline to show verticality. A vertical line could afford the blind child a guide by which to estimate a vertical position in relation to a body position which he is observing. This information would seem most important relative to movements which require a specific body angle in their execution.

It is conceivable that if figures of the human body were to be used to describe movement patterns to blind children, such representations would have little resemblance to figure drawings as viewed by the seeing. A line running full length down the center of the body might serve to facilitate the blind child's accurate interpretation of body angle.

Exaggeration of certain body parts in a drawing might be used to indicate the emphasis of an important consideration in a specific position or stunt. The problems of laterality and difficulties which may be found in reading side view figures might be further minimized by having the drawing posted on a wall with the child facing a like direction while responding to the drawing.

After each subject was tested, he was asked if he thought he might be able to more easily learn motor skills by reading the drawings. All but two declared that embossed drawings would be of

value. Three subjects mentioned that if the stunts were identified, they could concentrate on body positions. Another projected that clothes and shoes could facilitate identification of body parts, and one mentioned that right and left limbs might be labeled by a braille symbol.

Most subjects expressed that the side view drawings were more difficult to learn than front view drawings and that static positions were easier than sequential movements. The reason for the latter statement was that by the time they reached the last figure they had forgotten positions of the first. This problem might be resolved by having the child try the position where practicable, after interpreting each figure, when the sequence includes more than three or four figures.

The present investigation, having been exploratory in nature, offered numerous possibilities for future study. Suggestions for additional exploration follow.

1. Modification of embossed drawings might include:
    a. An experimentation with drawing size; and identification of various body planes by differences in texture, differing density, and by use of braille symbols.
    b. An exaggeration of anatomical differences of body parts.
2. Research on the use of the tool as a teaching aid, such as:
    a. A comparison of the use of the tool for gross motor skills versus fine motor skills.
    b. A comparison of subject verbalization with actual movement performance.

c. An exploration of the use of the drawings for teaching sports and gymnastics skills.

d. A consideration of using the tool to help with concepts of correct posture and body mechanics.

e. An investigation of methods devised to teach identity of body parts, laterality, and details of body angles.

3. Development of systematic assessment procedures such as the following:

a. A list of specific questions to be answered by subjects who are verbalizing about embossed drawings.

b. A scoring system to evaluate subjects' responses. Primary errors that are necessary for execution of the gross aspects of movement should detract more from the score than secondary errors of fine movement. The exact scoring system would depend upon the degree of accuracy desired, and would depend upon the nature of the particular movement.

4. Tests to determine subject knowledge about the body, body awareness, laterality, and space perception should be designed to classify subjects.

5. The study might be extended to adventitiously blinded children. Such an extension may reveal whether or not visual memory facilitates the reading and interpreting of embossed drawings.

6. A comparison between braille reading ability and the facility with which subjects are able to read embossed drawings might be explored.

A P P E N D I X A

DRAWINGS AND RESPONSES

OF SUBJECT "A"

APPENDIX A

DRAWINGS AND RESPONSES OF SUBJECT "A"

The tape recorded transcriptions of Subject "A" are included to demonstrate that the accidentally blinded, with possible visual memory, may be able to interpret, with reasonable accuracy, embossed drawings of human figures portraying movement.

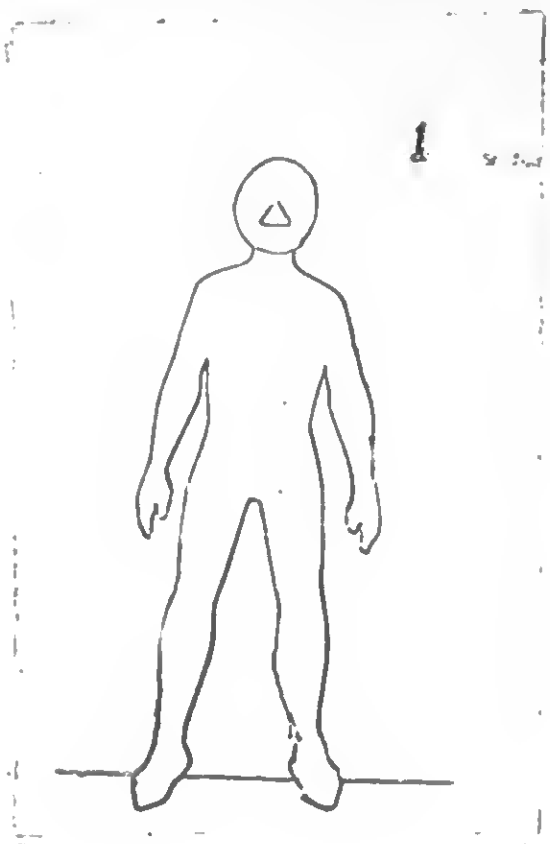
Responses for Subject "A" were not used by judges to evaluate the embossed drawings because this subject had useful vision in one eye until age ten. Thus, he did not satisfy the requirement that subjects be limited to those without visual memory.

This subject was presented all forty sequences, both the twenty used for training and the twenty to which he had not been exposed previously. The former are referred to as training drawings and the latter as testing drawings. During their testing sessions, other subjects were presented only the testing drawings, which were new to them. Training drawings were not presented to subjects during testing, other than to Subject "A", because of the time involved in taping and in judging their responses.

The embossed drawings of the $9\frac{1}{2}$" X $11\frac{1}{2}$" plastic sheets have been reduced photographically to facilitate their presentation in this report. Drawings are numbered and lettered to correspond with the subjects' tape recorded descriptions.

Subject "A" was fifteen years of age and in the eighth grade

when he was tested. He was tested in two days. Each day twenty sequences were presented.



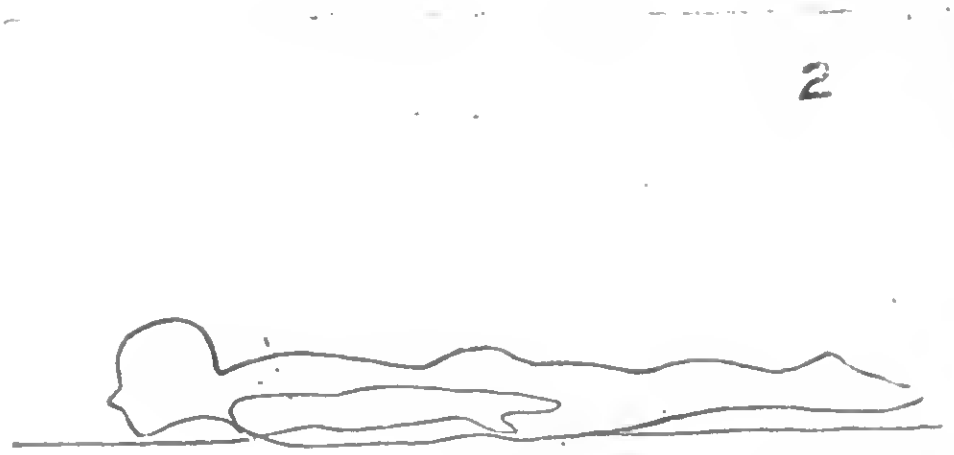
Drawing 1: Training

S. He's facing toward you, and he's standing erect with his arms down to his sides, and his thumbs are facing in.

E. Are his feet apart or are they together?

S. The toes are kind of spread apart, a little bit.

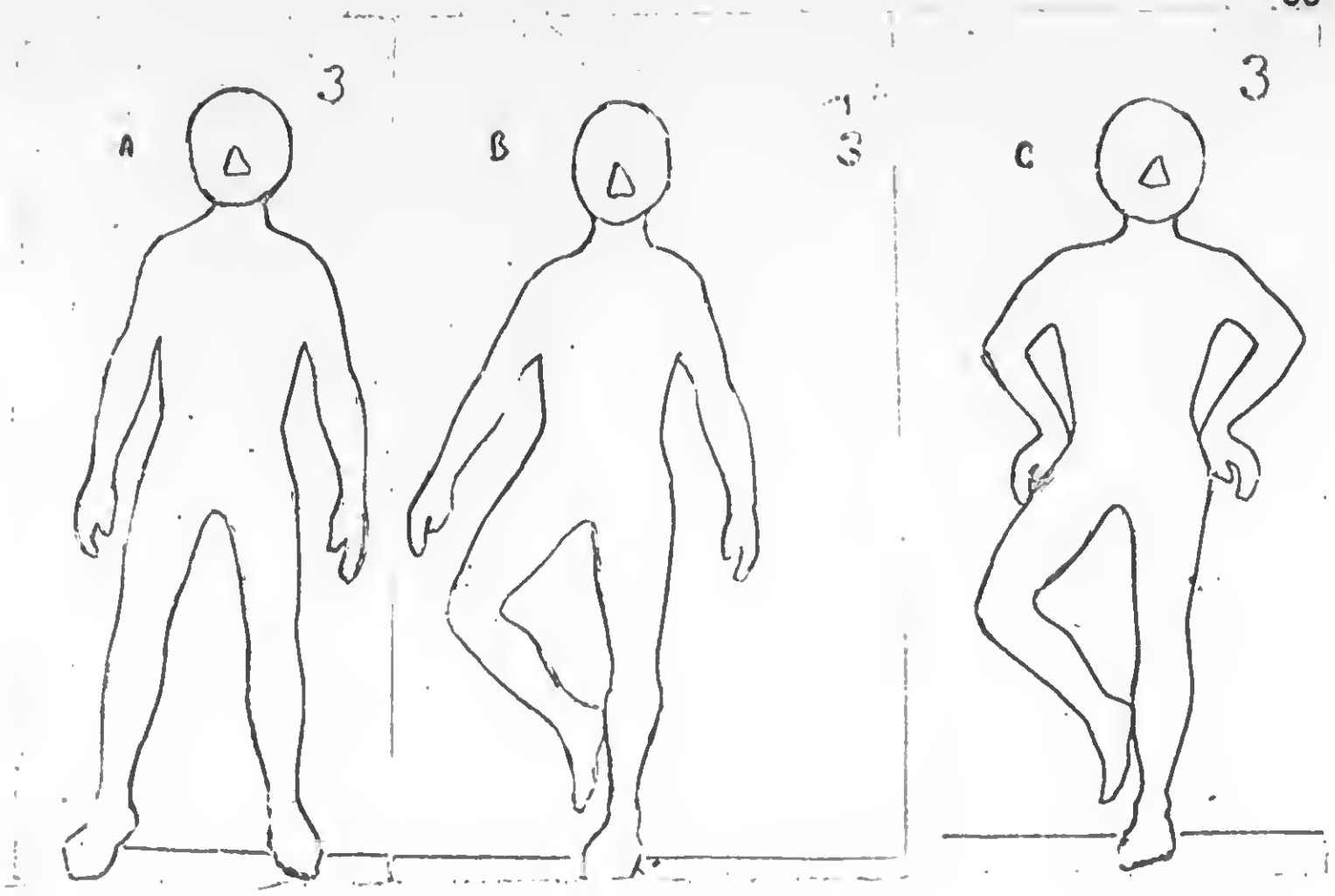
Drawing 2: Training

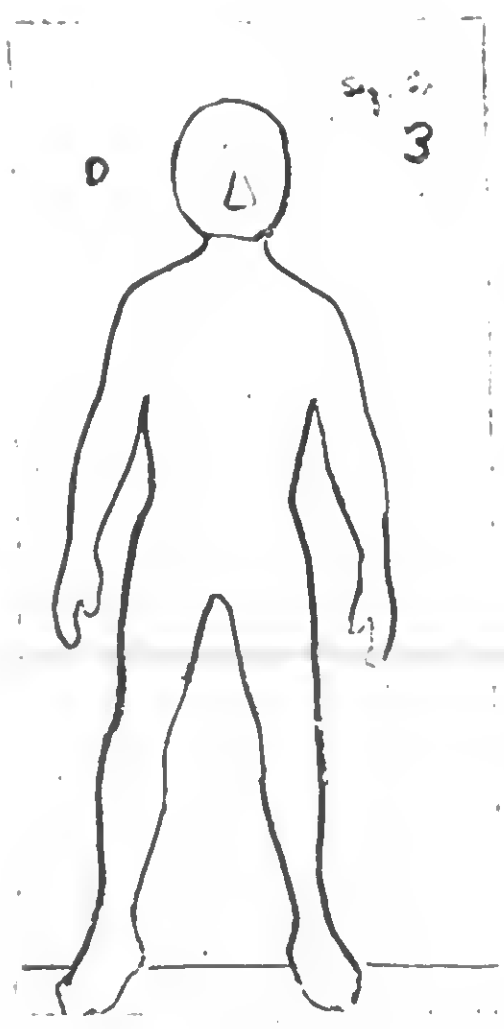


S. He's lying on the floor, and it's a side view with arms down to the side, and his thumbs are down towards the floor, and his toes are a little bit off the floor.

E. Is he on his stomach, or is he on his back?

S. He's on his stomach.





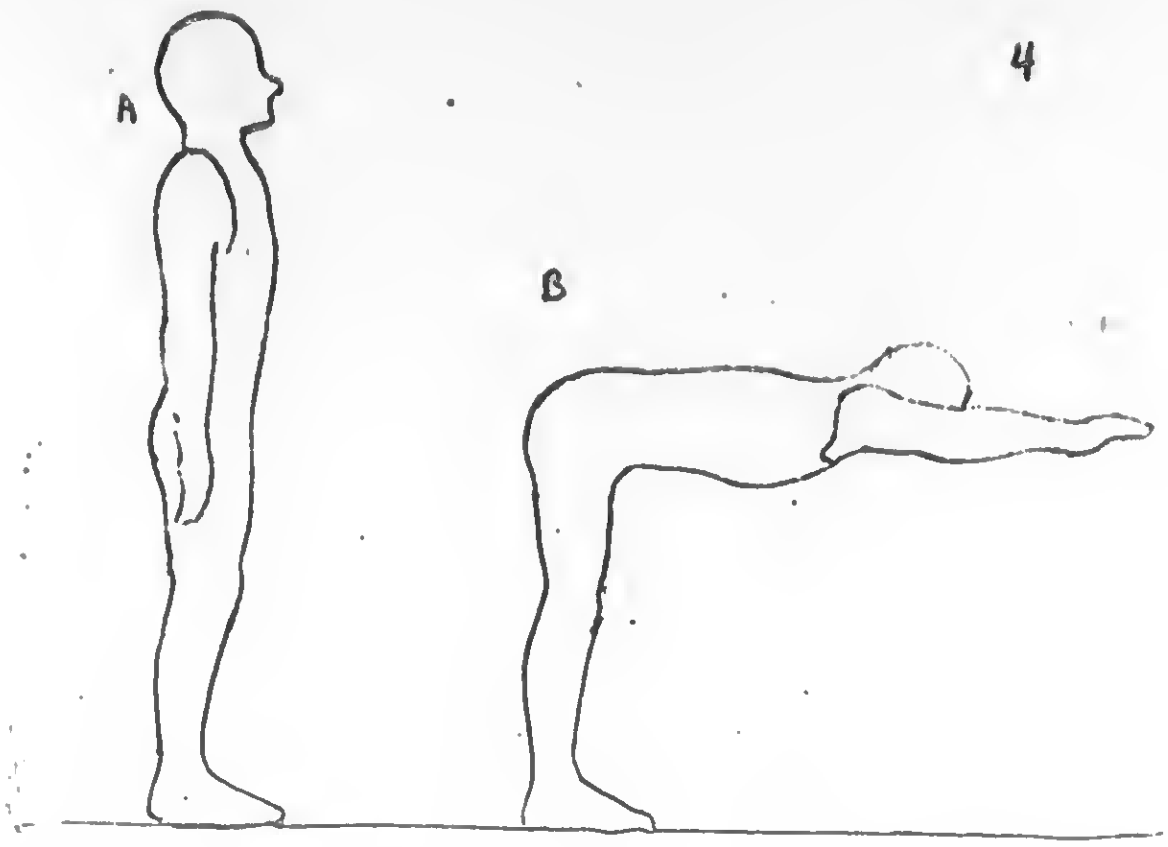
Drawing 3: Training

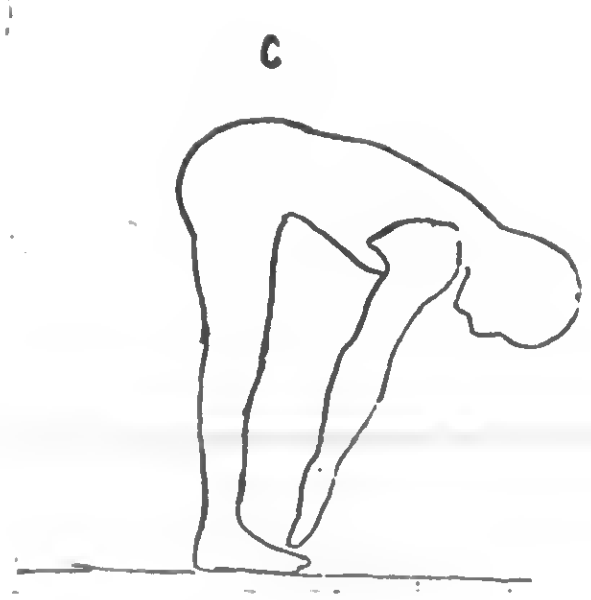
S. In the first sequence he's facing you with his hands down to his sides with his thumbs in, and his toes are kind of spread apart. In the second one it looks like he's leaning a little bit to the left, and his right leg is up, and the heel is on the back of his knee, and his hands are spread apart, but the thumbs are facing in. Looks like his left leg is bent.

E. Go on to the next one.

S. He has his hands down to his sides with the heels of his wrists on his hips, and he has his left foot on the floor and his right heel behind his left knee. In the fourth one he's back in the first position.

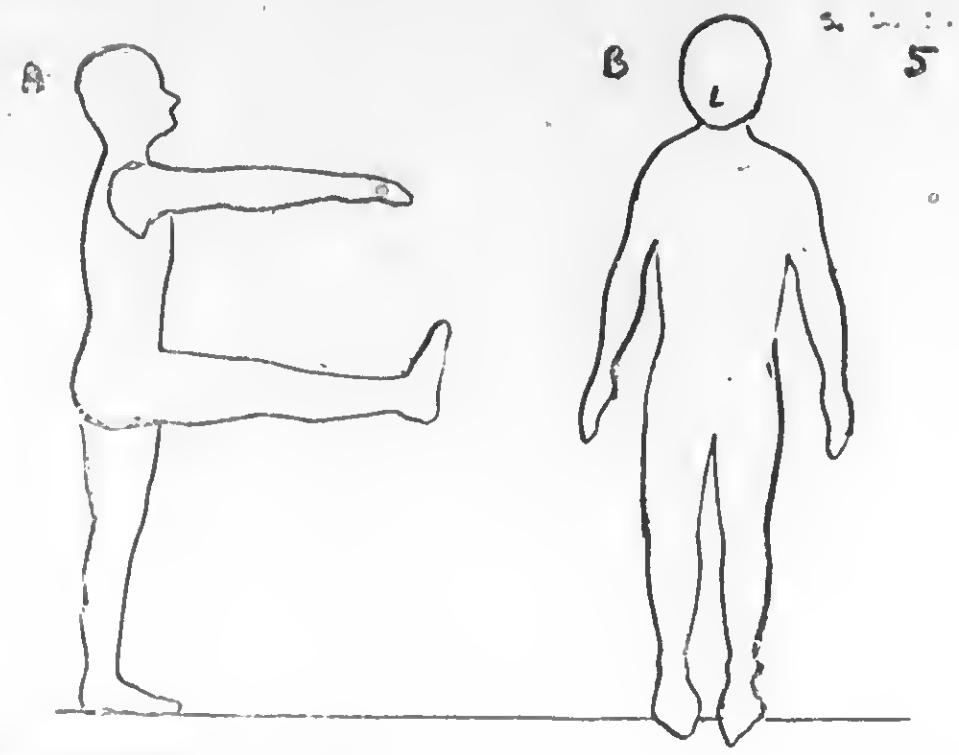
E. Okay, that's good enough.

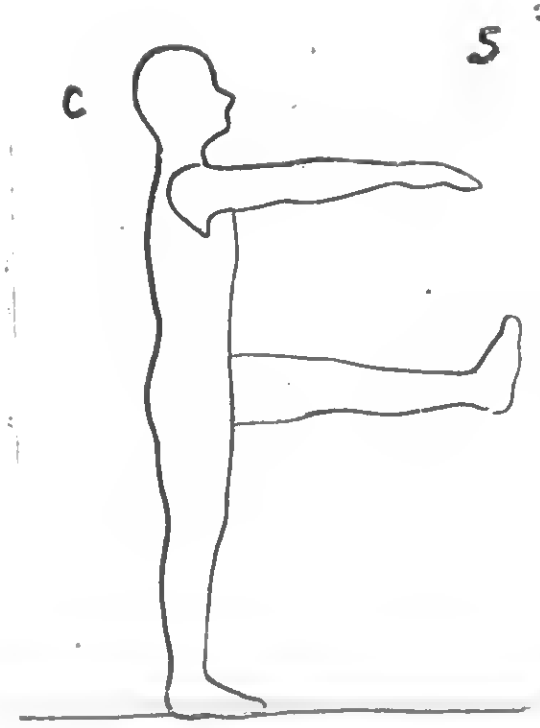




Drawing 4: Training

S. He is standing at the-- it's a side view with his right side facing you, and his hands are dowm to his sides, and it looks as though he's standing at attention. In the second one, he's bent over with his arms stretched out in front of him, and in the third one, he's bent over with his toes, I mean his hands, touching his toes.





Drawing 5: Training

S. He has his right foot straight out in front of him, with his left foot on the floor, with both arms stretched out in front of him, and it's a side view. The second one is a front view, and he's standing with his arms down to his sides, and in the third, it's a side view with his right side facing you. His arms are stretched out in front of him. His left leg is up in the air and his right foot is on the floor.

Drawing 6: Testing

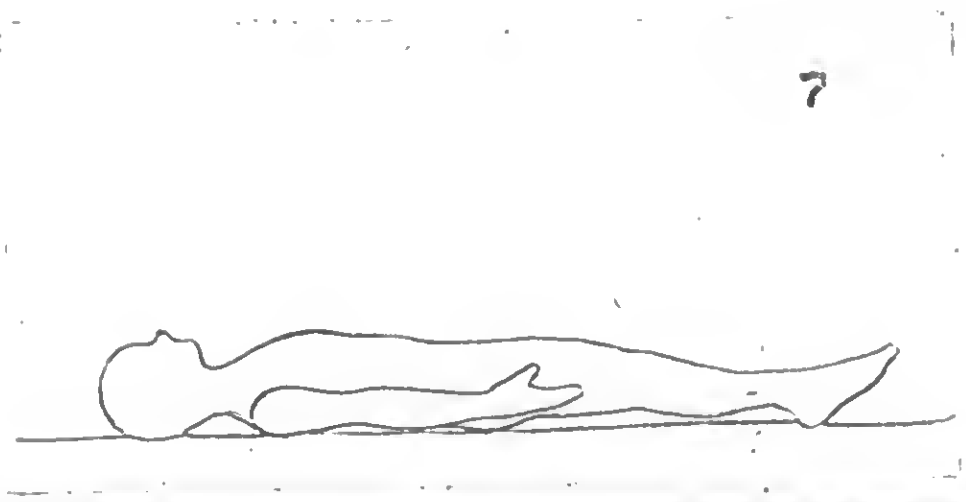
S. He's faeing toward you with his arms spread apart, and he's leaning toward the left side with his left leg bent, and his feet are spread out, and his toes are out toward eaeh side, and I think I mentioned he is slanting.

E. You said his left knee was bent. How about his right knee?

S. His right knee is bent also, but not as mueh as the left one.

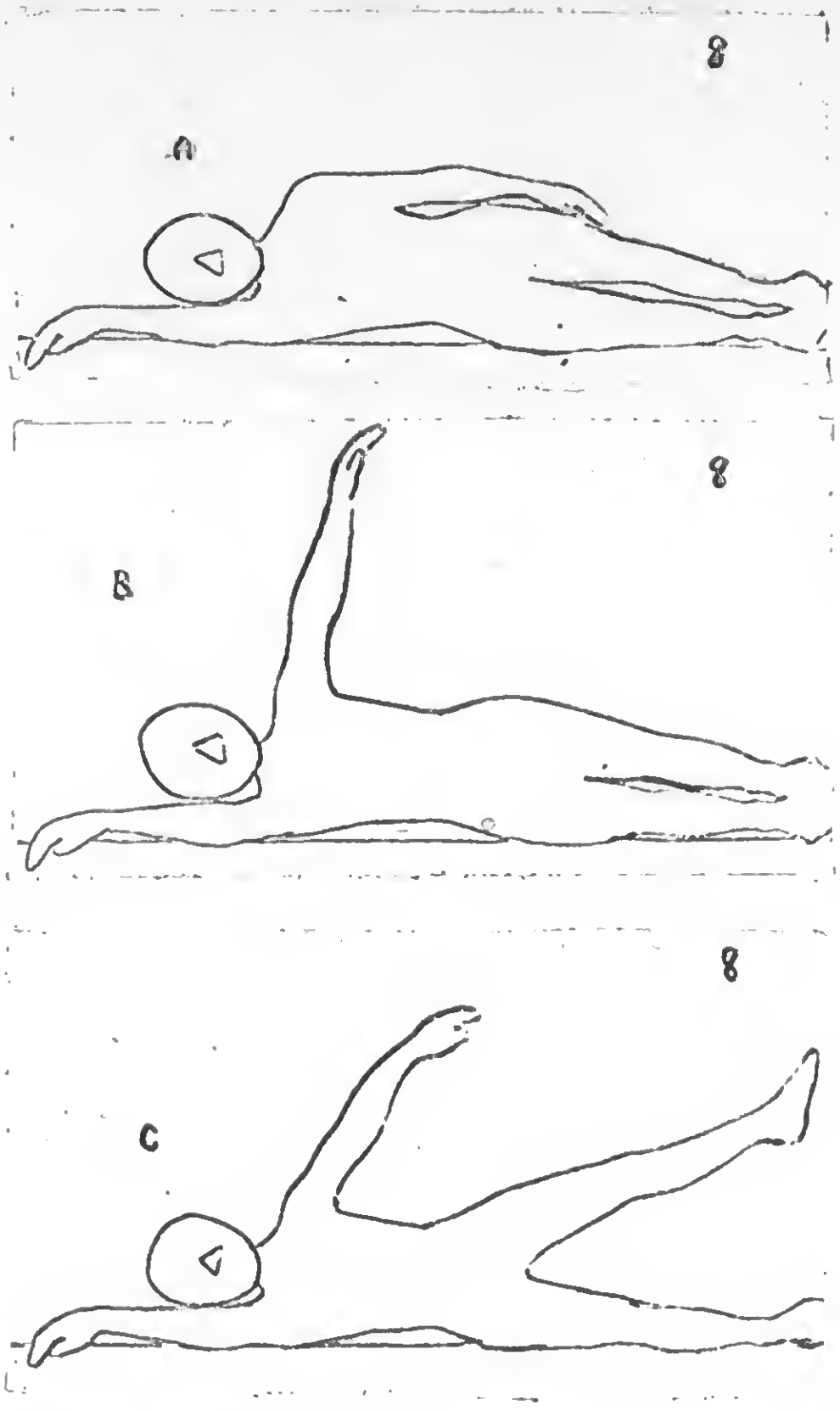
E. In what direetion are his palms?

S. His palms are in towards his body.



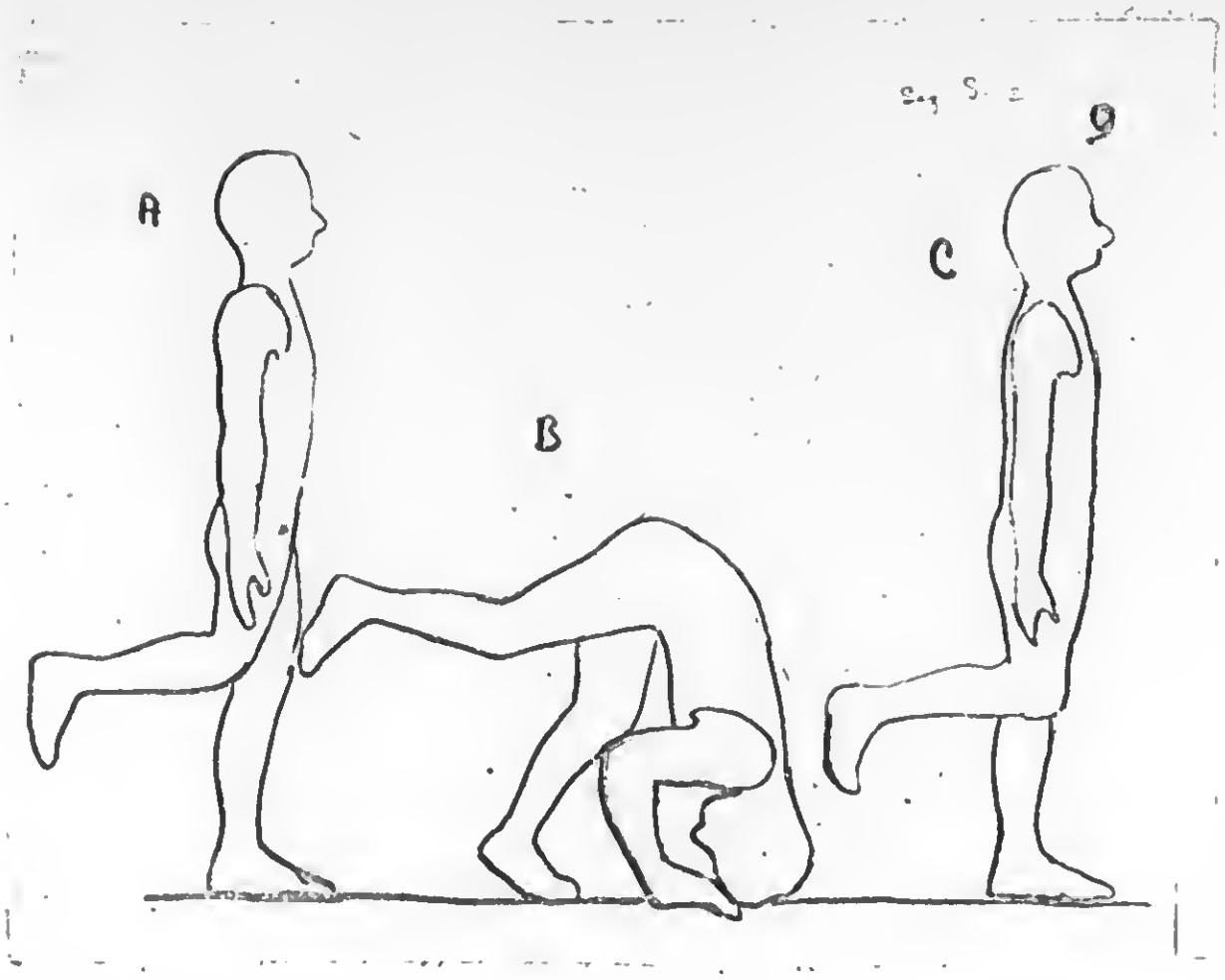
Drawing 7: Testing

S. He is lying on the floor on his back with his arms down to his sides, and his thumbs are facing up, and his toes and his feet are bent away from his faee.



Drawing 8: Testing

S. He is lying on his right side with his left arm down to his side and thumb facing in, and he has his right arm running up alongside his head, like his head is resting on his right arm. Now, in this second one, he's still on his right side with his left hand pointed up in the air, and his head is raised up off his right arm, and that's about the only difference between this and the first one. Next, this is the same as before except he has his left leg sticking up in the air with his toes, I guess, like pointing up towards the ceiling.

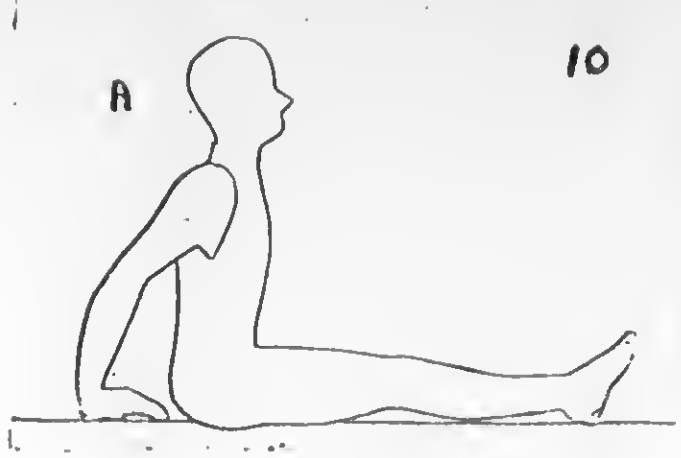


Drawing 9: Testing

S. He has his arms down to the side with his thumbs facing toward the front of him to the direction he's facing. His right leg is bont to the back of him, and his right toes are facing towards the floor, and his left ones are on the floor. In the second one, he's bent over with his hoad on the floor, and his hands are on the floor. His left leg is bent, and just his toes are touching the floor, and his right leg is sort of bent, and it's facing toward the back of him. Now, in the last one he's standing the same as he was in the first drawing, only his--. No, I guess that's right. Yes, now I see. He's standing the way he was in the first drawing.

10

A



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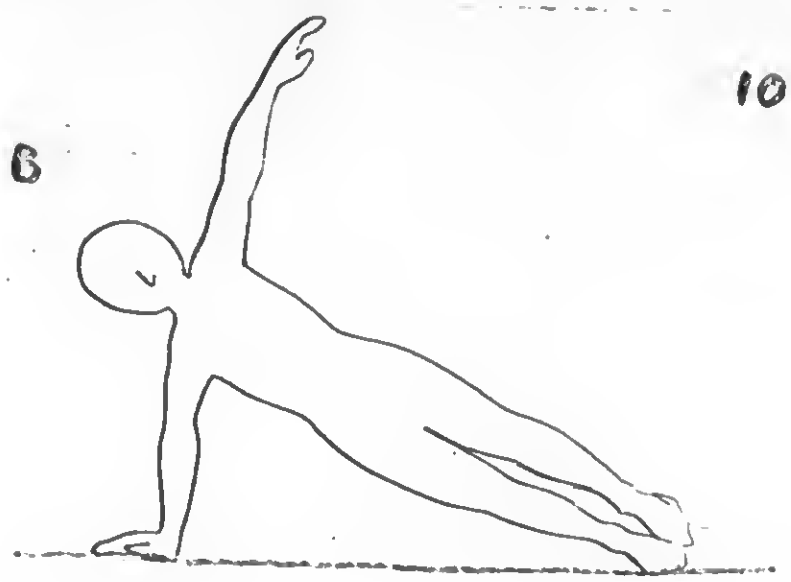

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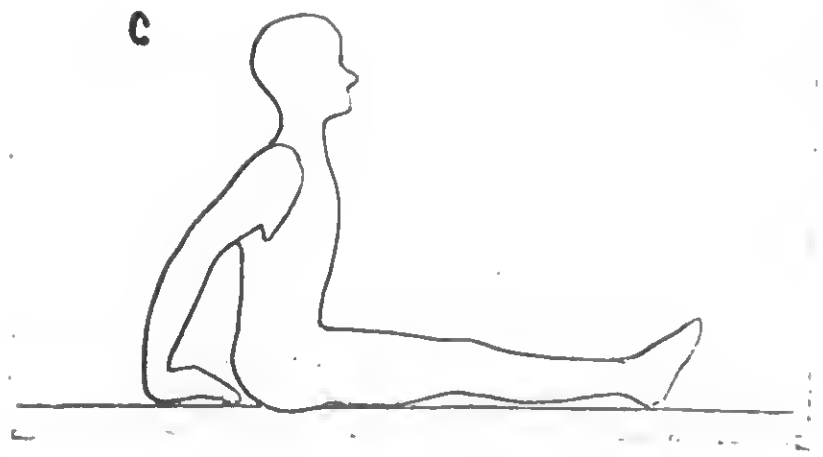
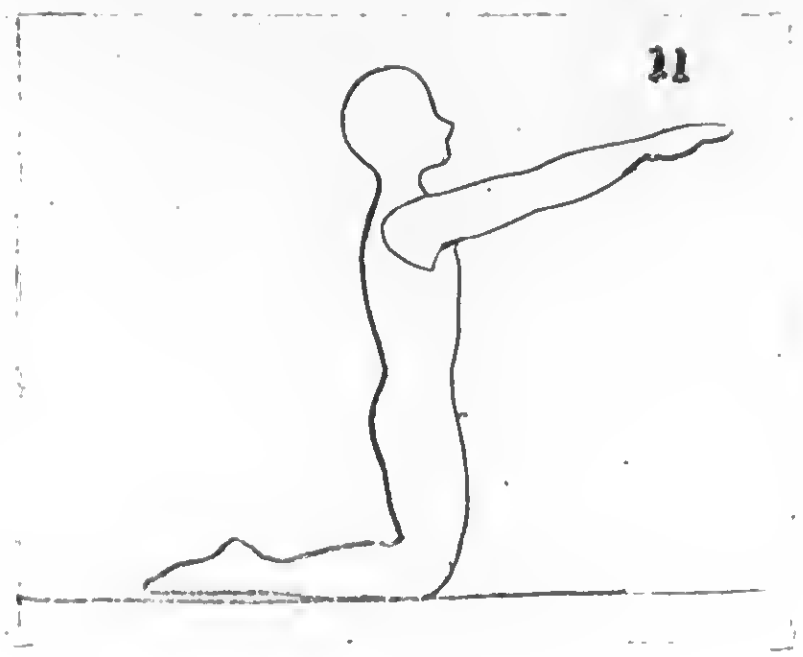


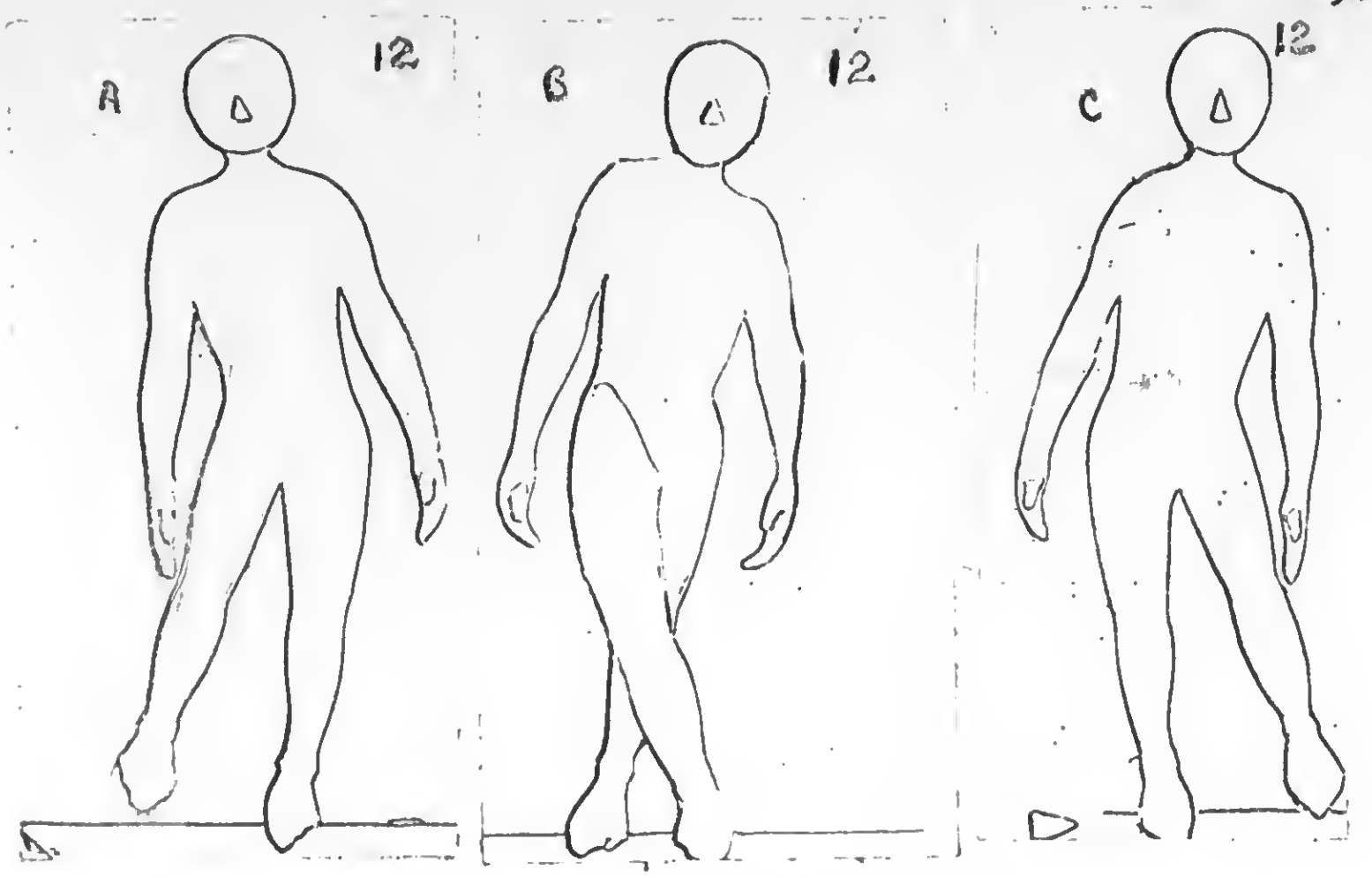
Drawing 10: Testing

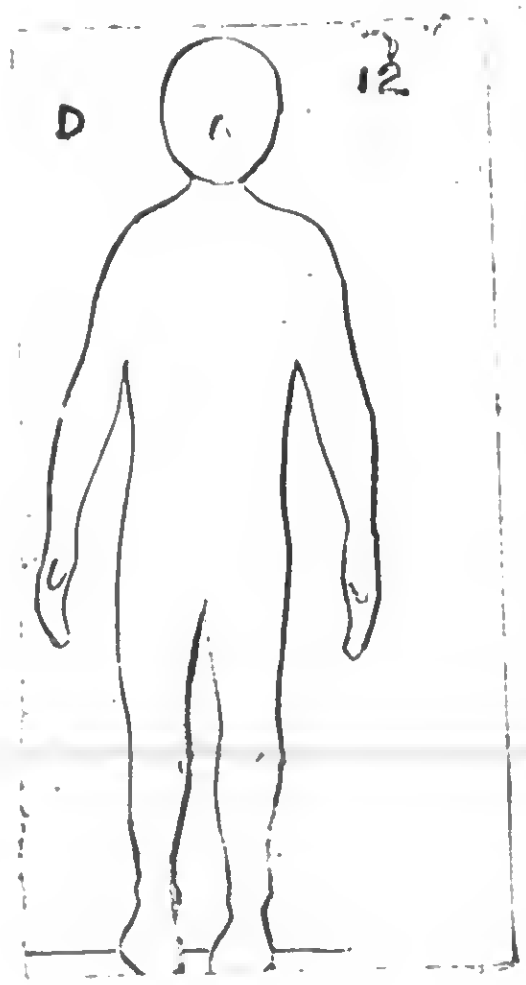
S. He is sitting on the floor with his right side facing you. His hands are back behind him on the floor, and his fingers are facing in with his feet and his legs stretched out in front of him, with his toes pointing up. Now he's holding himself up facing toward you with his right hand and his right foot--his legs are together, and his left hand is sticking up in the air. Now he's back in the position he was in in the first drawing, sitting on the floor with his hands behind him.



Drawing 11: Training

S. He's on his knees with his right side facing you and his arms stretched out in front of him.





Drawing 12: Training

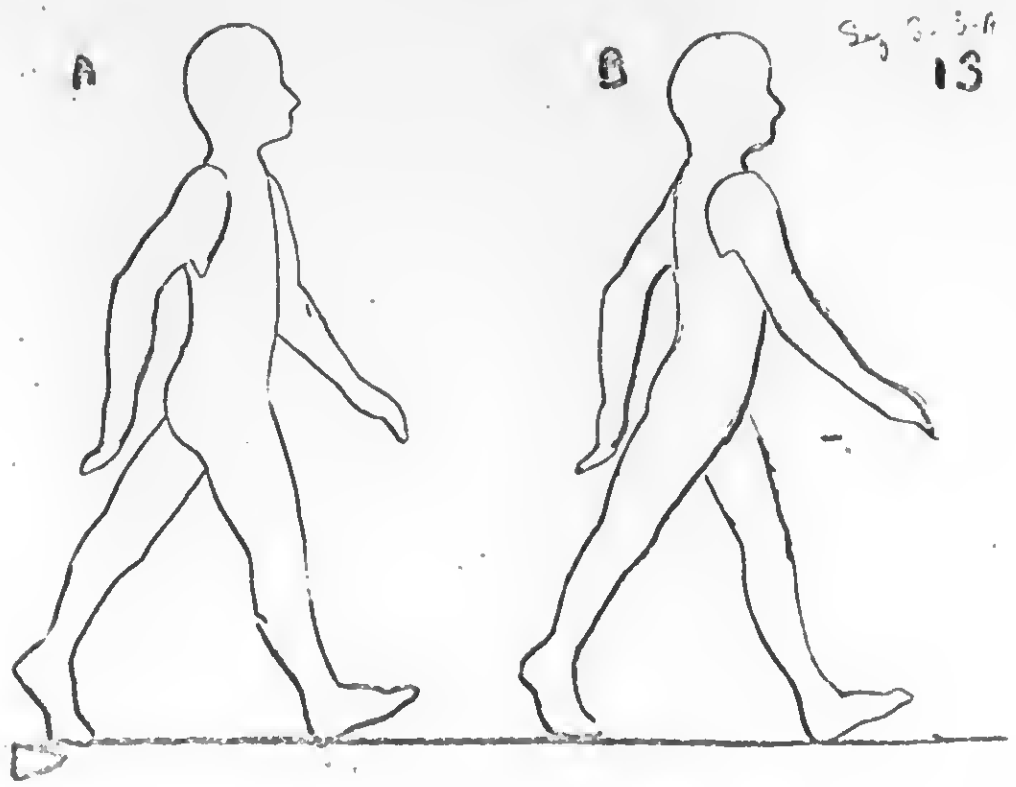
S. There's a triangle in the corner, so that means he's moving from one spot to another. In tho first one, he's standing on one foot--his left foot--with his right foot slightly off the floor, with his hands down to his sides, and he's facing you. In the second one, he has his left--or wait--no, his right foot--(the tape was stopped here to allow S time to further scan the drawing). He took his right foot and crossed it over in front of his left leg.

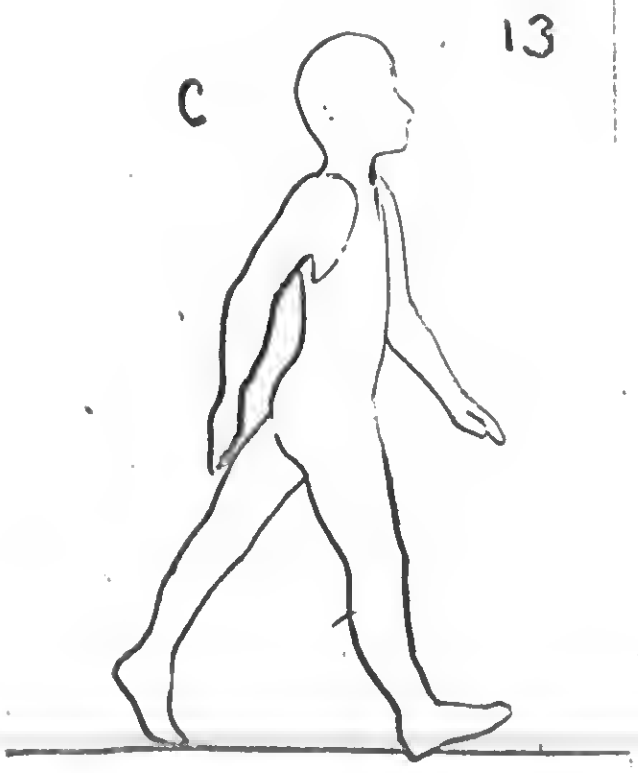
E. Okay, next one?

S. His right foot is down on the floor and his left foot is just a little bit, not very much, off the floor. His arms are down to his sides. On the next one, he's standing with his arms down to the side, and both feet are on the floor.

E. Are they together or far apart?

S. They are together.





Drawing 13: Training

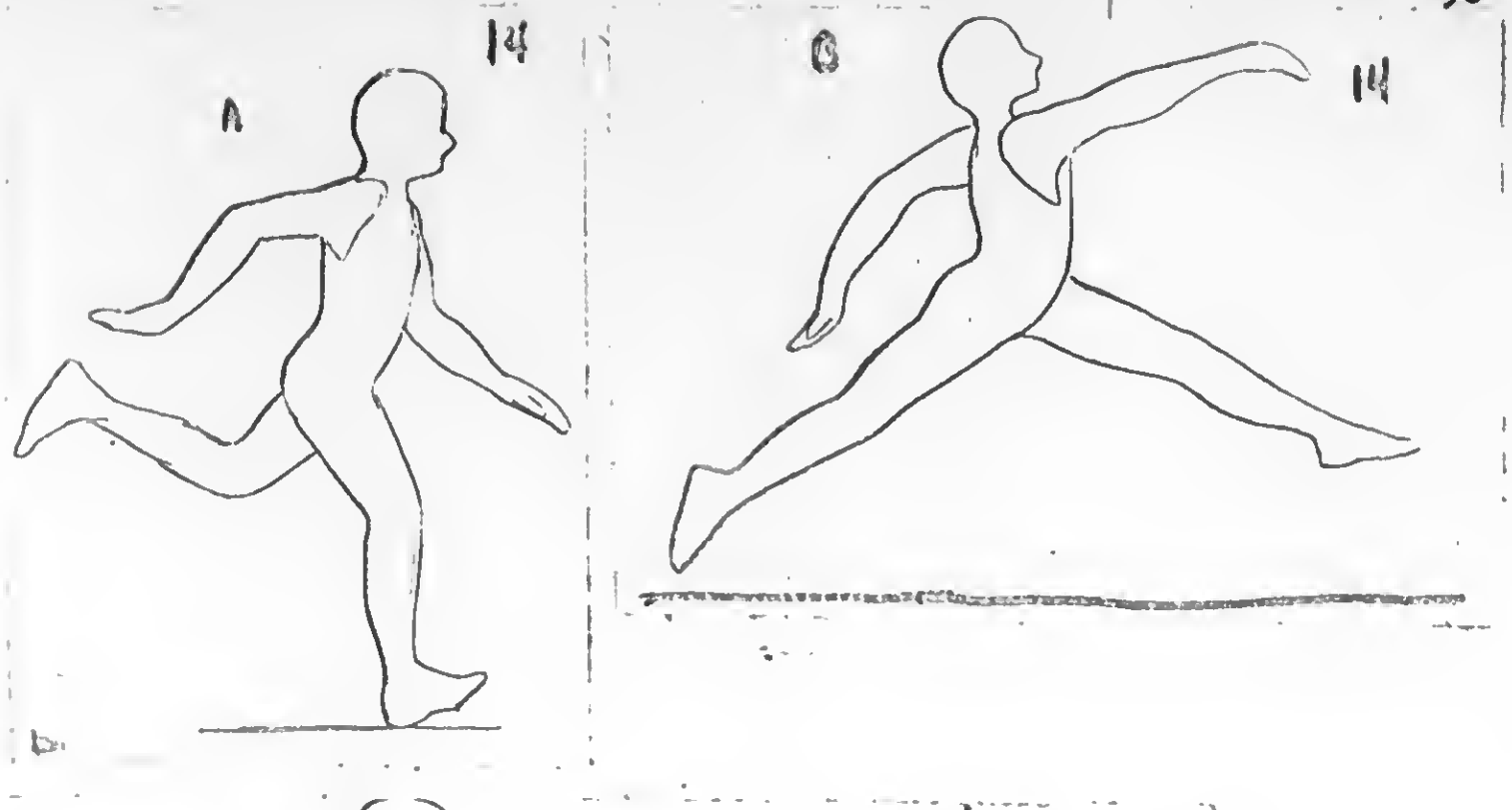
S. Down here is the triangle. His right leg is out in front of him on the floor. His left leg is behind him with his toes just touching, and just his right heel is touching on the floor. His right arm is behind him, and his left arm is in front of him. Now, in the next one, his right leg is behind him, and his left leg is in front.

E. Okay, go to the next one before you tell me what he is doing.

S. He is the same as before--in the first drawing.

E. What do you think he might be doing?

S. Probably walking, I think.



Drawing 14: Training

S. There's the triangle again, and his right leg--I mean--right foot is on the floor with just his heel touching, and his--both knees are bent, and his left foot is behind him. His right arm is bent, and it's--his right hand is behind him, and his left arm is in front of him. Next one, both feet are off the ground, both his legs are straight but they're spread apart. His right arm is in front of him and his left arm is in back of him.

E. What does it appear that he's doing right now?

S. Leaping or something.

E. Now the next one. This is the same sequence.

S. Now his left leg is behind him again, with his knee bent, and his right leg is in front of him and is pointing at about a forty-five degree angle down towards the ground.

E. And what is the next one doing?

S. Facing you, with both feet on the floor.

E. How about his legs? Are they straight or are they bent?

S. They're bent.

E. Go back to the one you just did. Which leg appears to be closer to you?

S. The left leg--the right leg, rather.

E. The right leg. Is that what you meant to say?

S. Yes.

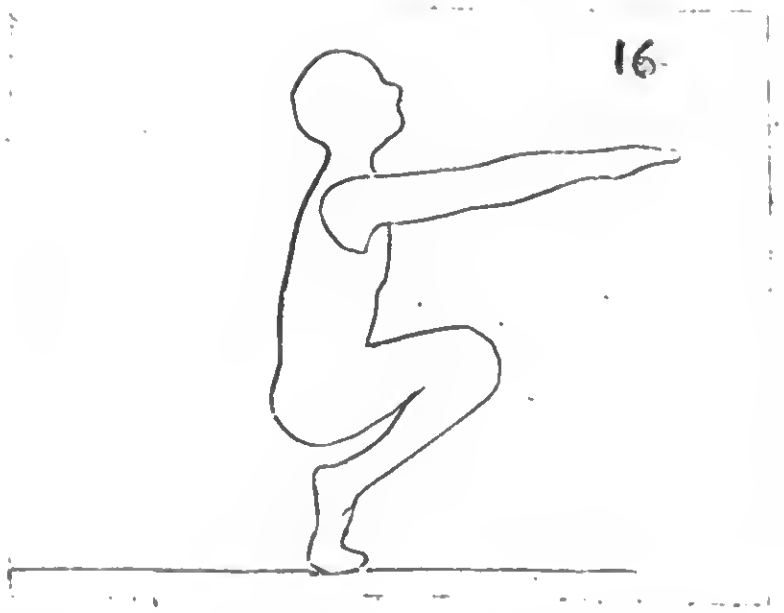
E. Or, did you really think that that(left) was closer?

S. Well, it does look like it's closer. I guess it's kind of like seeing a person--close to you looks larger than this far away, but I don't know if that would be any larger, actually.

Drawing 15: Training

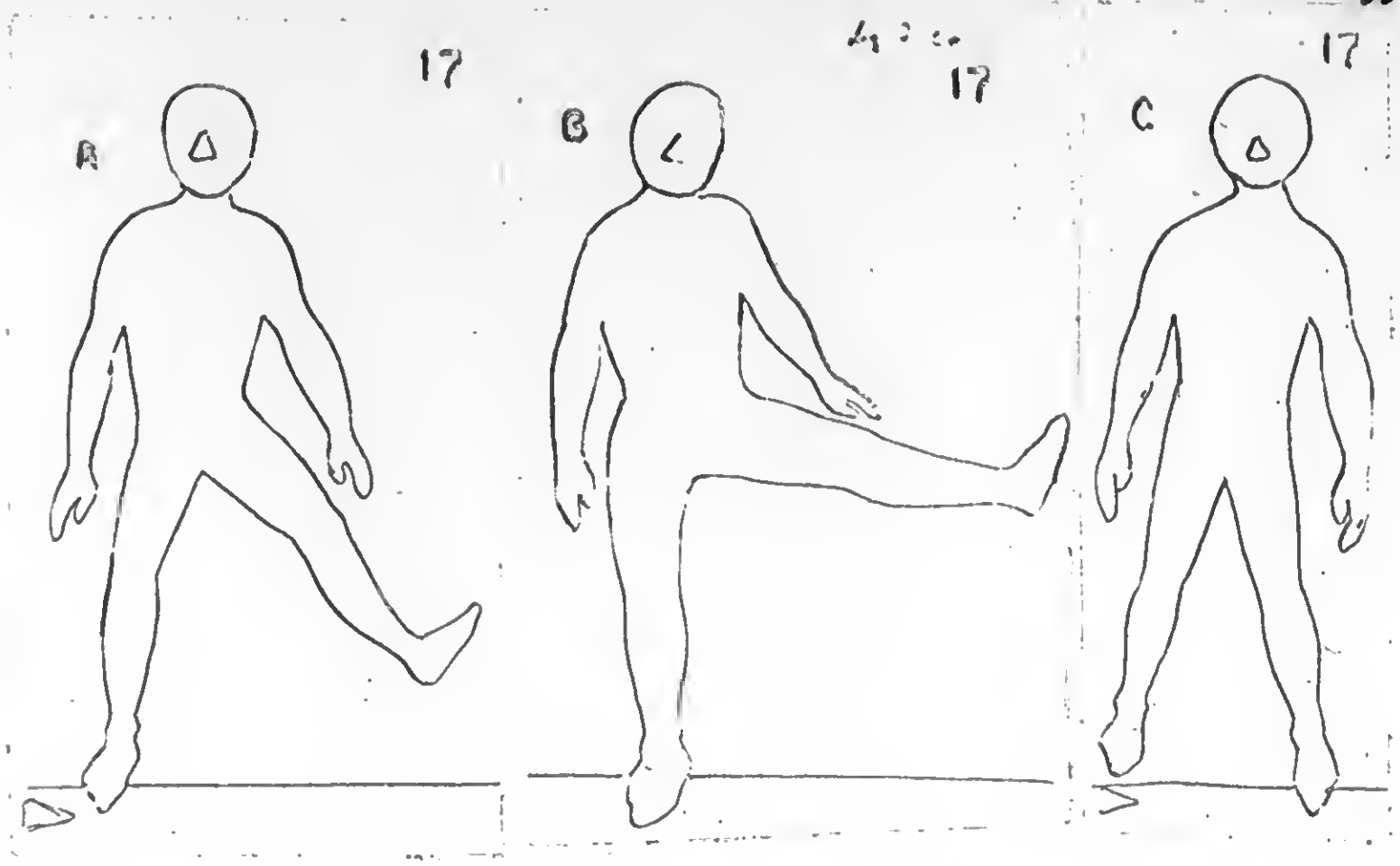
S. He's facing you with his right hand on the floor with his fingers pointing away from him, and he's sitting on the floor. Both his legs are extended out to his left with his left hand resting on them.

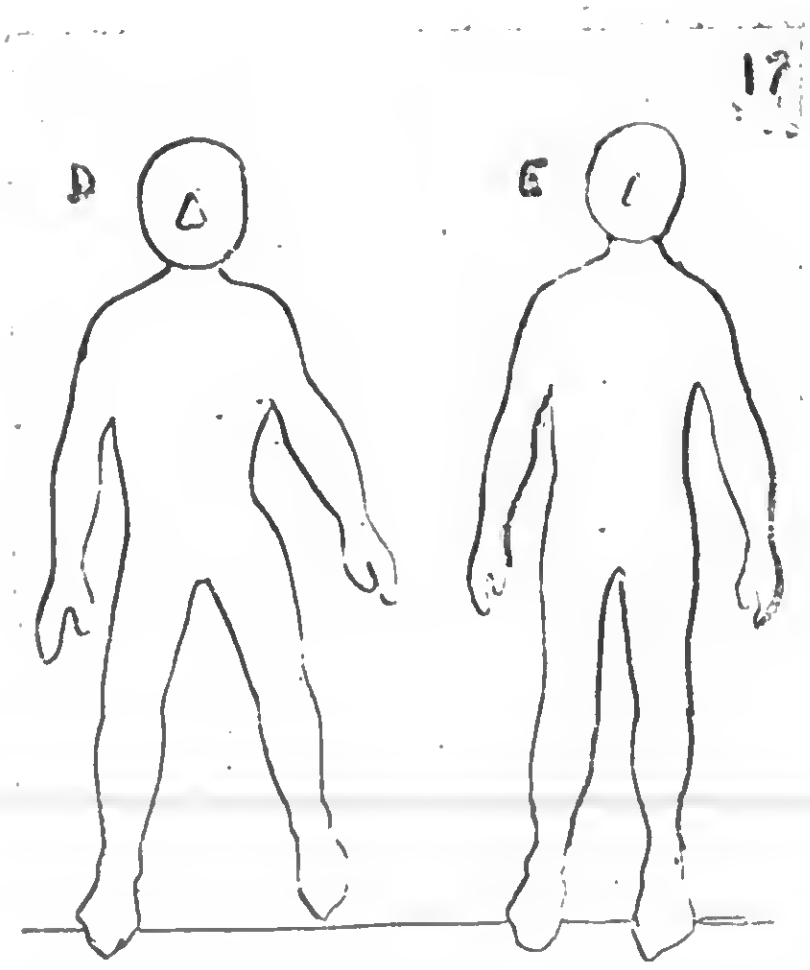
E. At this point, S turned the paper upside down to determine right and left.



Drawing 16: Testing

S. It's a side view, and he's bent down, or he's squatting, and he's on his toes with his arms stretched out in front of him.

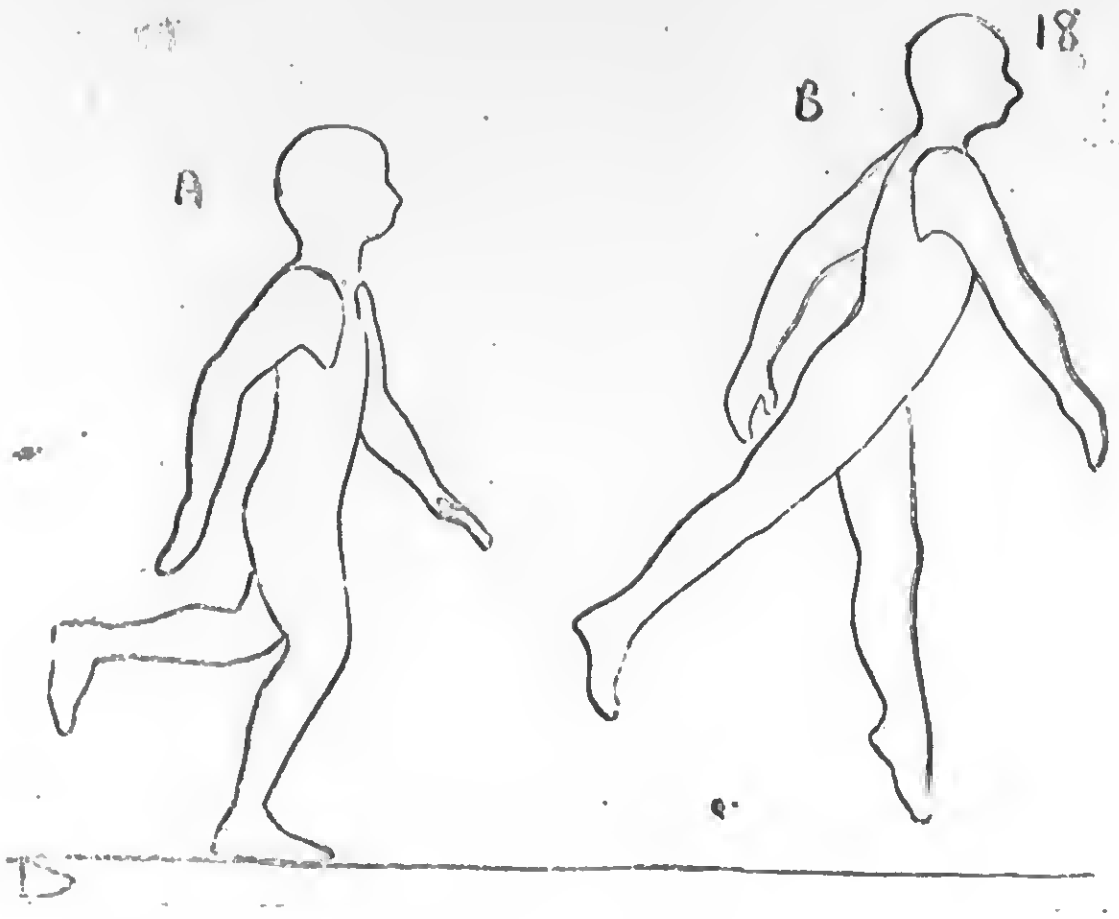




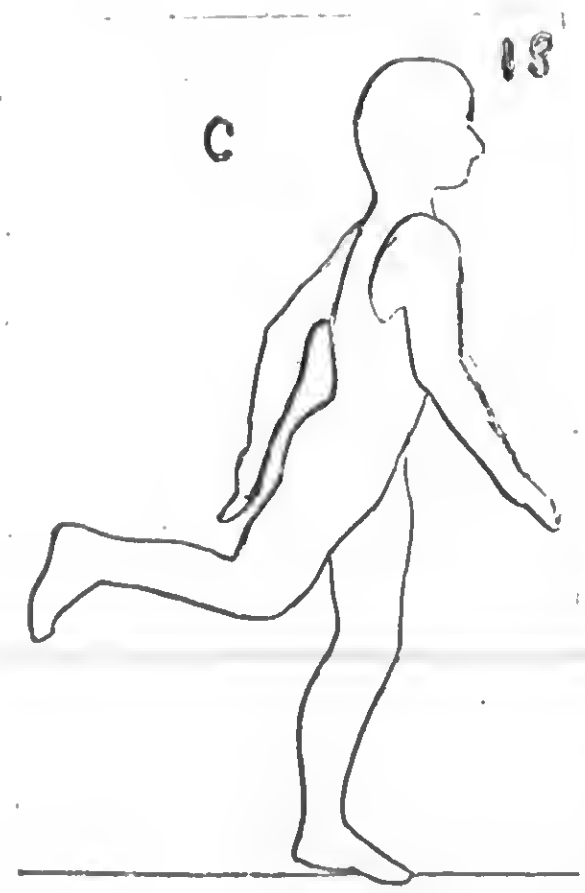
Drawing 17: Testing

S. He's facing you with his arms down to the side. His right foot is on the floor, and his left foot is extended out at a forty-five degree angle with his inside of his left foot facing you. The next one is the same as before, only his left leg is extended straight out to his side with his left hand resting on it. On the next, his left foot is on the floor, and he's picking up his right foot, and in the next one, he's got his left foot up off the floor, picking it up off the floor. Then--

(Note; The remainder of S's response to this sequence, to the last figure, was inadvertantly erased from the tape)



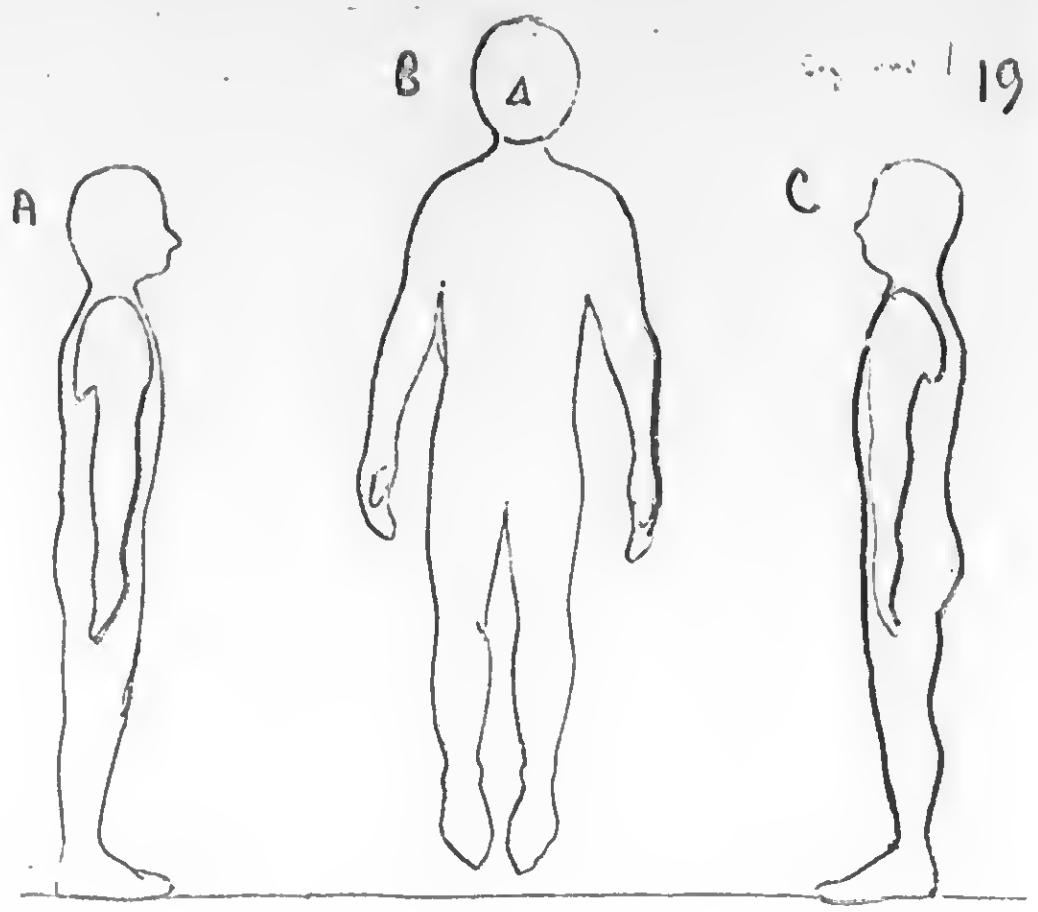
Drawing 18: Testing



S. Down here in the corner is a triangle, so I guess he's going from one spot to another. It's a side view with his right side facing you, with his right foot on the floor. His knee is kind of bent, and his left leg is bent with his foot behind him. His right arm is back behind him a little bit, and his left arm is in front of him. In the next one, both feet are off the floor with his right foot in back of him and his left foot in front of him. His left arm is behind him with his right arm in front of him. Now, in the next one, his right arm is in front of him, and his left arm is in back of him as before, and it's the same as before, only his foot is on the floor--his left foot is on the floor.

E. Can you think of what he might be doing?

S. I would guess probably running. I'm not sure, but I would think running.



Drawing 19: Testing

S. The first picture is a side view with his right side facing you, and his arms are down to the side.

E. Where are his feet on that one?

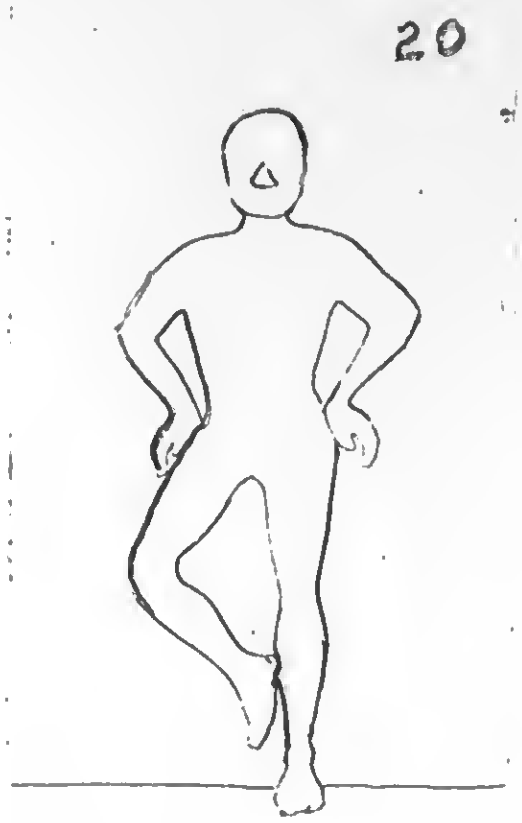
S. On the floor.

E. Legs straight or bent?

S. Bent. No, straight--I mean they're straight. In the next one, he's facing you with his feet off the floor and his arms down to his sides. In the third one, it's the same as the first one, only his left side's facing toward you.

E. What do you think he might be doing?

S. He kind of jumped and turned around one hundred and eighty degrees.

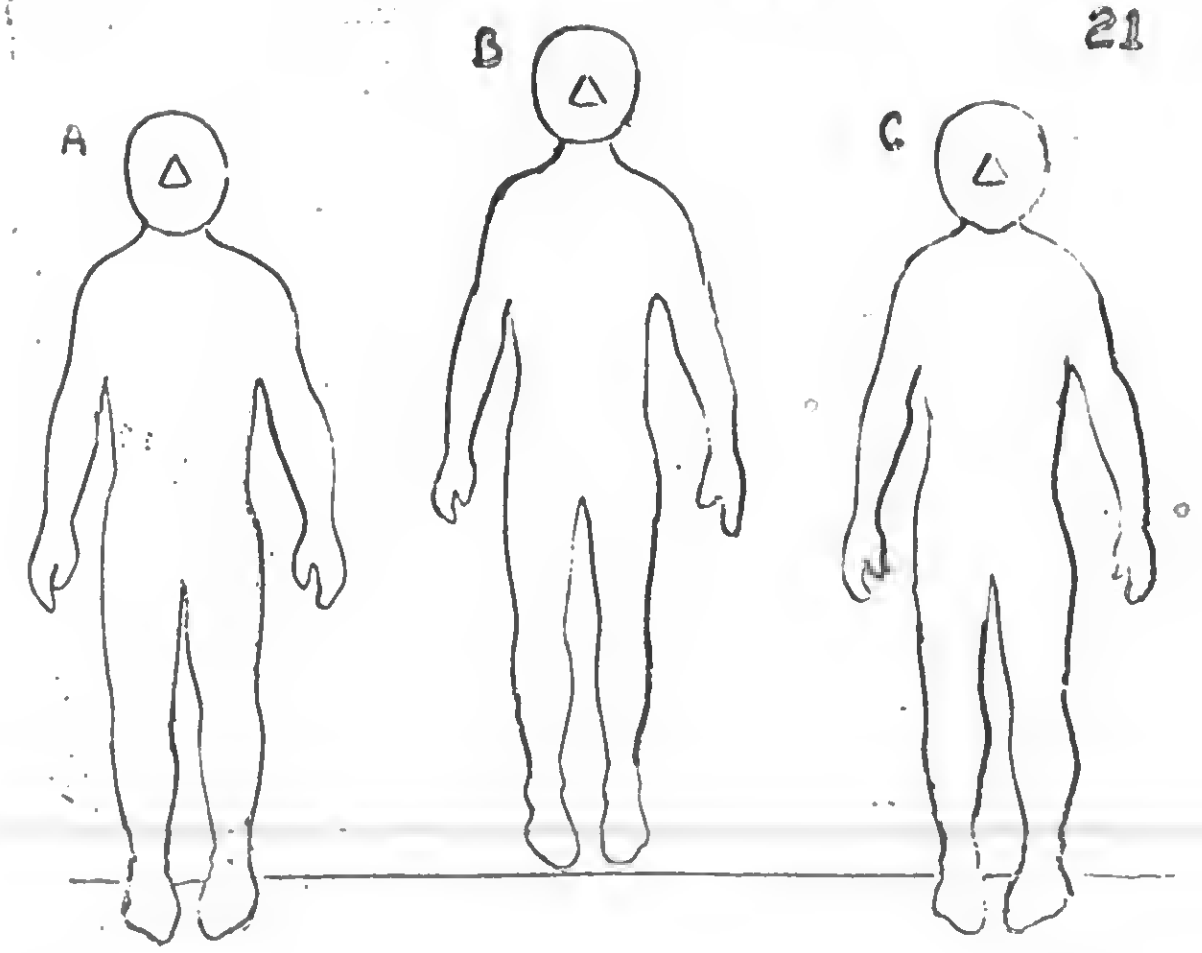


Drawing 20: Testing

S. He's facing toward you with his right leg bent, and his right heel is resting on his left knee, and both hands are on his hips.

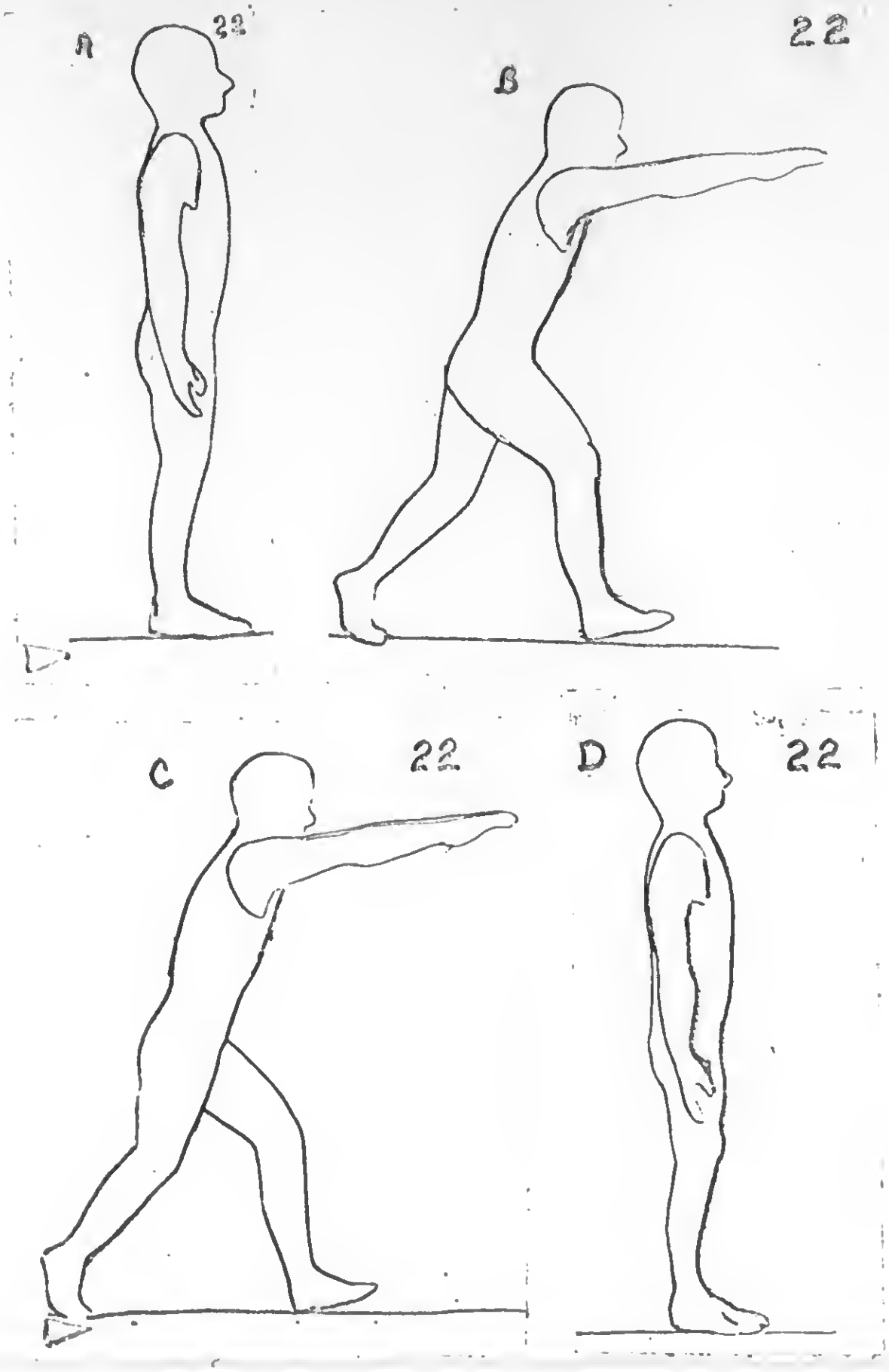
E. What part of the hand?

S. The heel of the hand.



Drawing 21: Training

S. He's standing facing you with his feet together and his arms down to his side. In the second one, his arms are down to his side, and his feet are just slightly off the floor. In the third one, he is standing on the floor again, and it looks just slightly like his feet are closer together on the third picture.



Drawing 22: Training

S. There's a triangle on the corner. First, we have his arms down to his sides, and in the second one--

E. What are his legs doing on the first one?

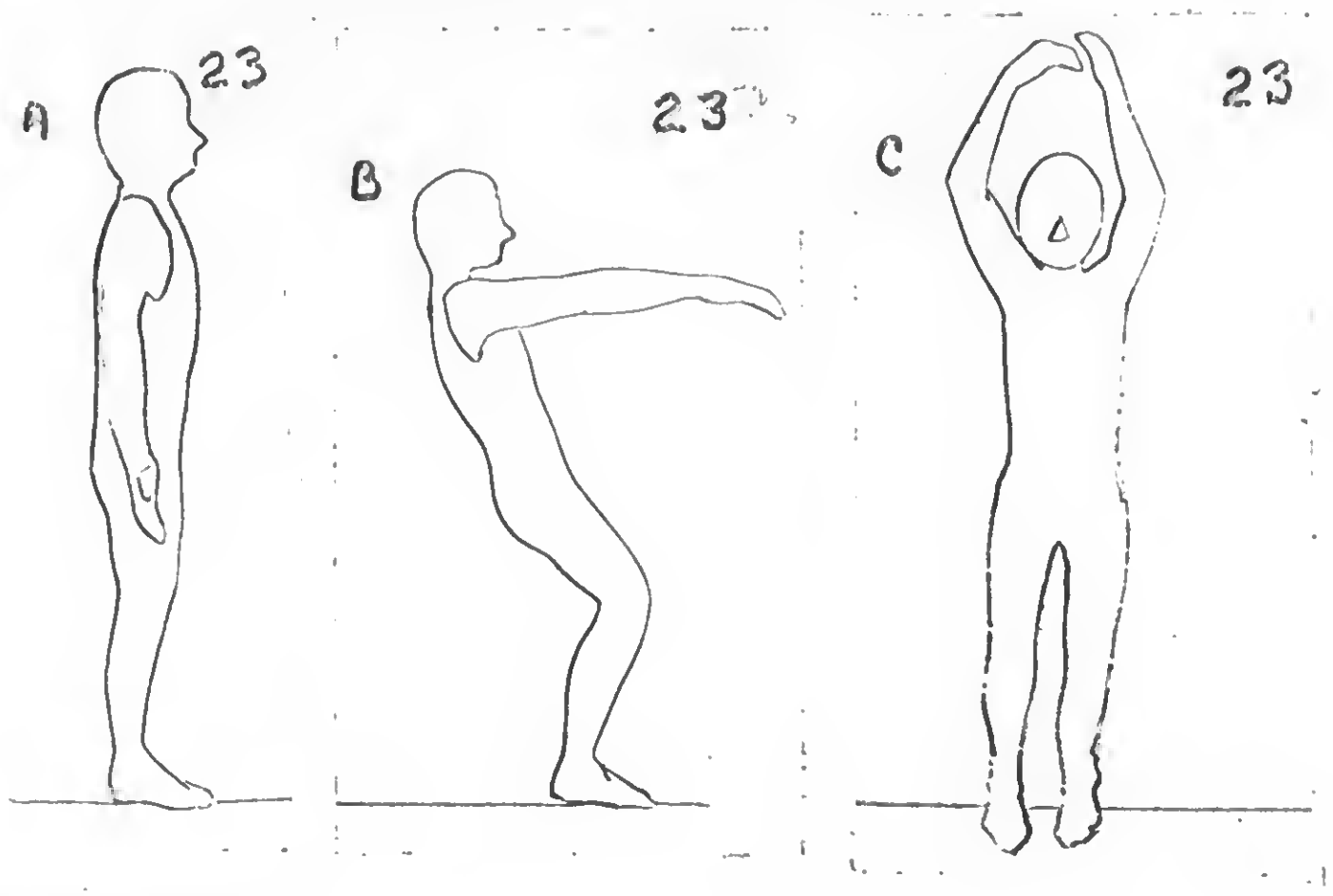
S. The legs are just supporting him, I guess you'd say.

E. Okay. Where are his feet?

S. His feet are on the floor. In the second one, his arms are in front of him, and both legs are bent, and his right leg's in front of him with just his right heel touching the floor, and his left leg--foot--is behind him with his left toe touching the floor. In the next one, his left leg is in front of him, and his right leg is behind him with his right toe touching the floor and his left foot touching the floor, or his left heel touching the floor. In the fourth one, he's standing as he was in the first one.

E. On the third one--before that--where are his arms? Same place as before, or someplace different?

S. They're stretched out in front of him.

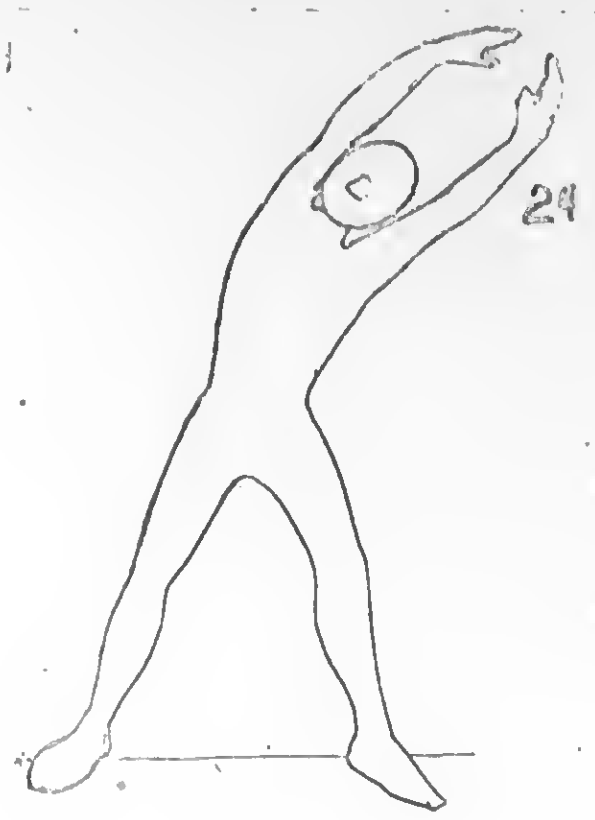


Drawing 23: Training

S. He's standing erect with his arms down to his side, and on the second one, he has his arms stretched out in front of him, and his legs are bent slightly. In the third, one of his arms are above his head, and he is facing you with his feet on the floor, and his left hand is above his right hand a little bit.

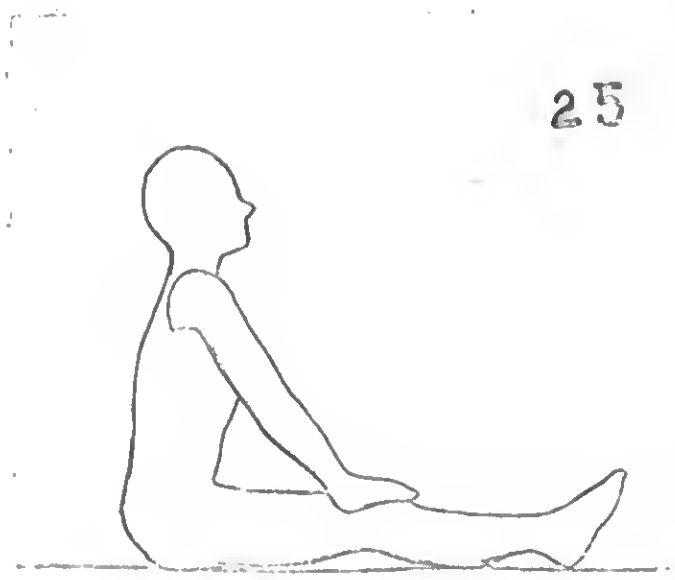
E. Let's look at that second one again. Is his body in the same position as it was in the first one, or is it any different? His torso, that is.

S. His body is bent slightly--tilted to the back.



Drawing 24: Training

S. He has his toes spread apart--his legs are spread apart, and his toes are bent away from each other on each of his feet, and he's facing toward you with his body slanting slightly, and his hands are above his head with his right arm directly over his head, and his left arm is just above his head.

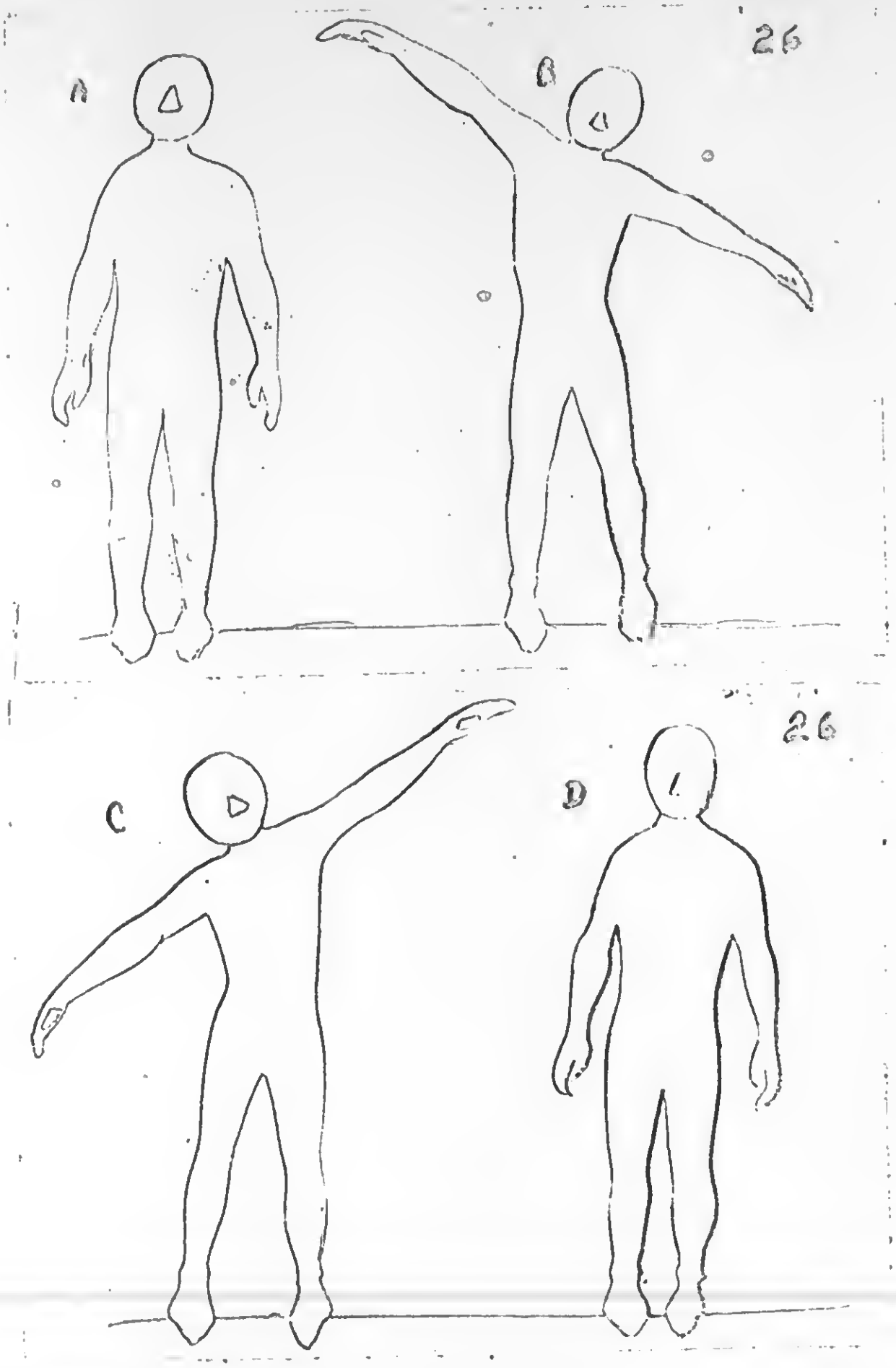


Drawing 25: Training

S. He's sitting on the floor with his hands on his knees, and his toes are pointing upward.

E. Are the legs bent or straight?

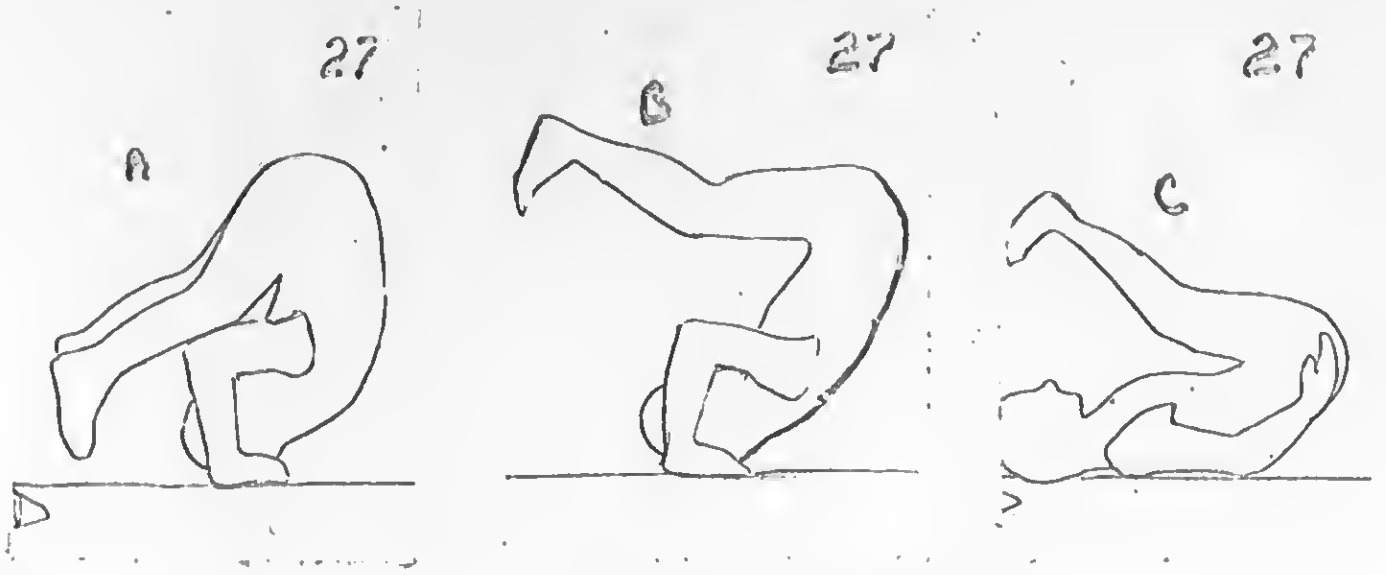
S. Straight.



Drawing 26: Testing

S. In the first one, he's standing with his arms down to the side, and both feet are on the floor. In the second one, his legs are spread slightly apart, and both hands are stretched out with his right hand higher than his left hand is. In the next one, his left hand is higher from his head than his right hand is, but they're still

spread out. He must have lowered his right arm and raised his left arm, and his legs are still spread apart, and now on the fourth one, he's in the same position that he was on the first one.



Drawing 27: Testing

E. Before S worked at this, he scanned all the figures in the sequence.

S. On the first one, he's bent over with his hands on the floor and his head between both his hands. In the second one, his hands are still on the floor, and this time he's raising his feet up in the air. In the third one, his back--most of his back--is on the floor now, and his feet are almost level--not really level--but almost, and in the fourth one, he's sitting on the floor with his legs straight and his arms down to his side.

E. Where are his hands there?

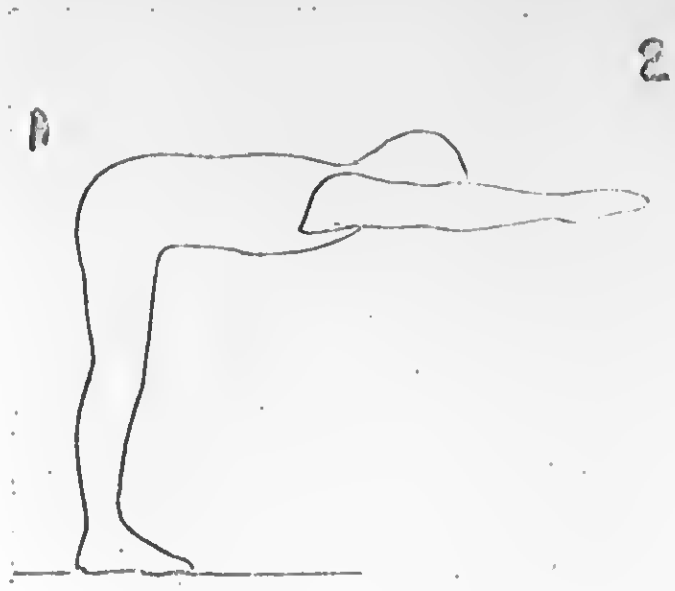
S. His hands are on his knees.

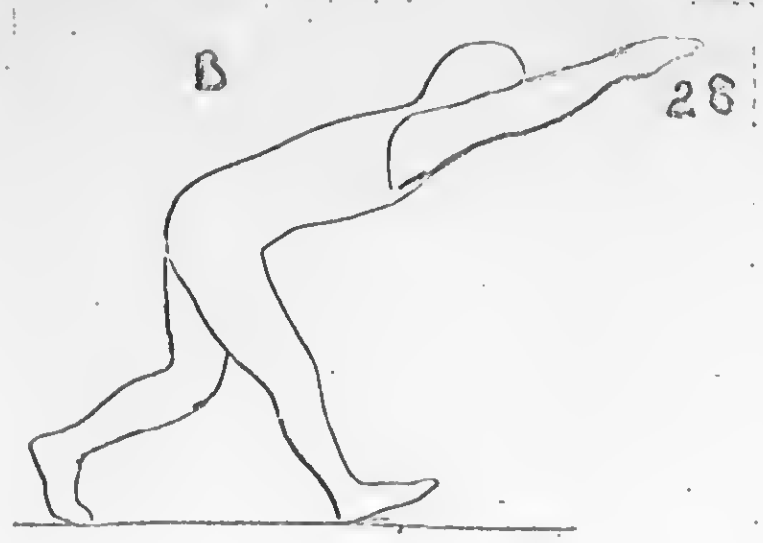
E. What do you think he might be doing?

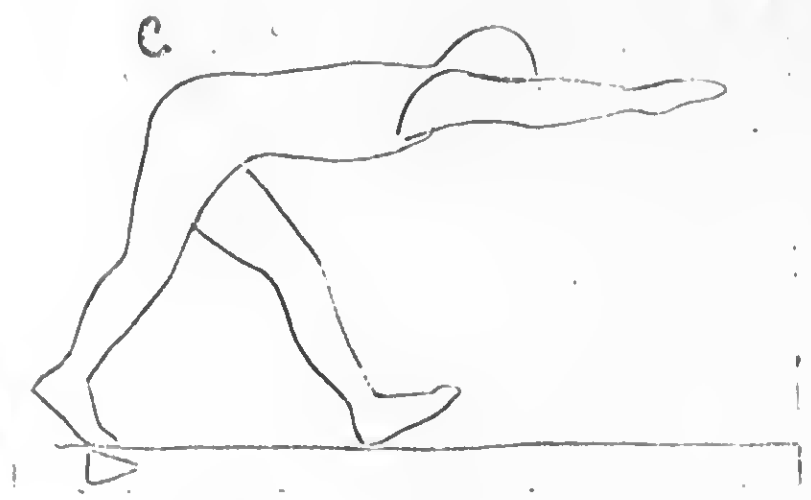
S. A sommersault.

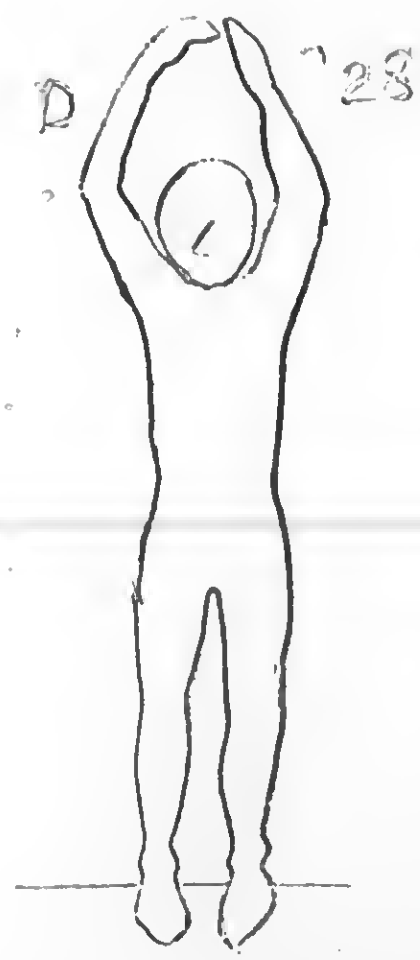
E. On the next to the last one, where are his legs? You said, "level". Level with what, do you think?

S. His thighs look like they're level with the floor, but his legs really aren't that level.



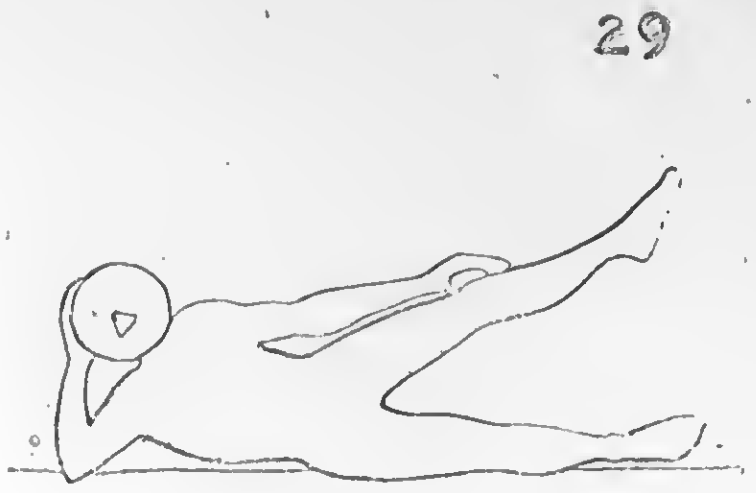






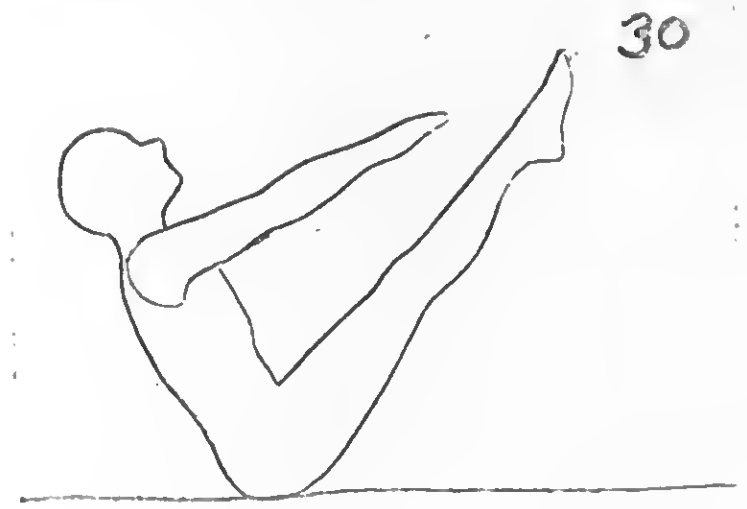
Drawing 28: Testing

S. Side view, and he's bent over with his arms stretched out in front of him. In the next one, his legs are spread apart, his right leg's in front of him, his left leg's in back of him, his right heel's on the floor, and his left toes are on the floor. On the next one, his right leg is behind him with his left leg in front of him. His right toe's on the floor, and his left heel is on the floor, and he's still bent over with his arms in front of him. In the last one, both feet are on the floor, and he's facing you with his hands above his head.



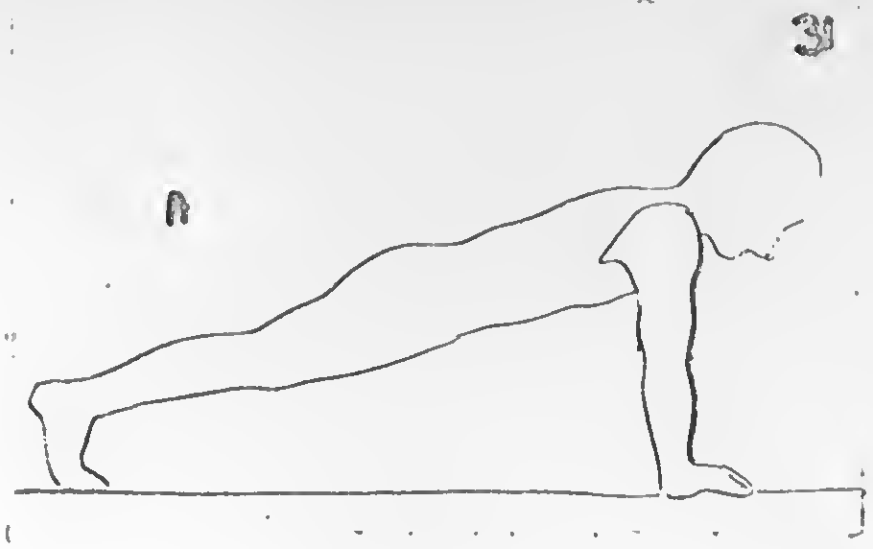
Drawing 29: Testing

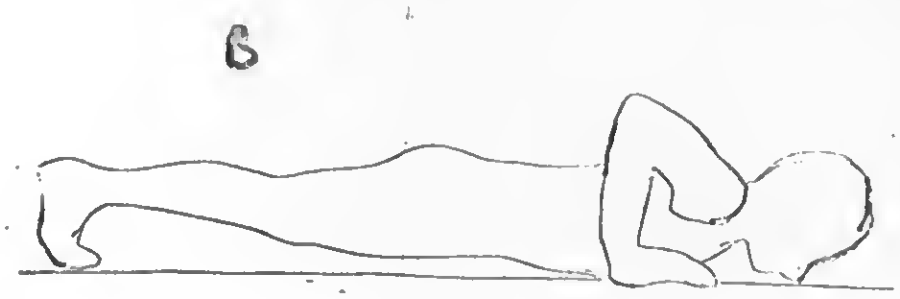
S. He's lying down on his right side, both legs are straight, his left leg's sticking up in the air with his toes pointing up, and his left hand is on his left leg, and he's resting the side of his head on his hand, and that's resting on his elbow.

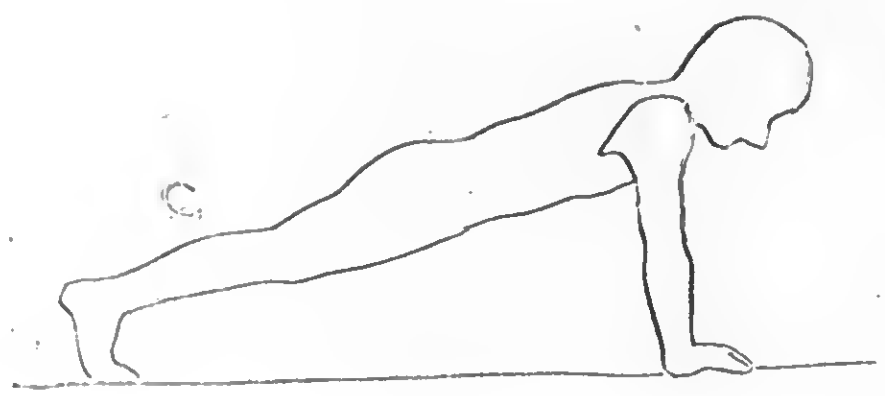


Drawing 30: Testing

S. He's sitting on the floor with his legs sticking up in the air, and his toes are pointing up. His arms are stretched out in front of him, and I guess he's balancing on his bottom.







Drawing 31: Training

S. On the first one, his hands and toes are on the floor, and his body's suspended by his arms.

E. Are his arms and legs straight or are they bent?

S. They're straight. On the next one, he's lying on his stomach on the floor.

E. What other body parts are on the floor?

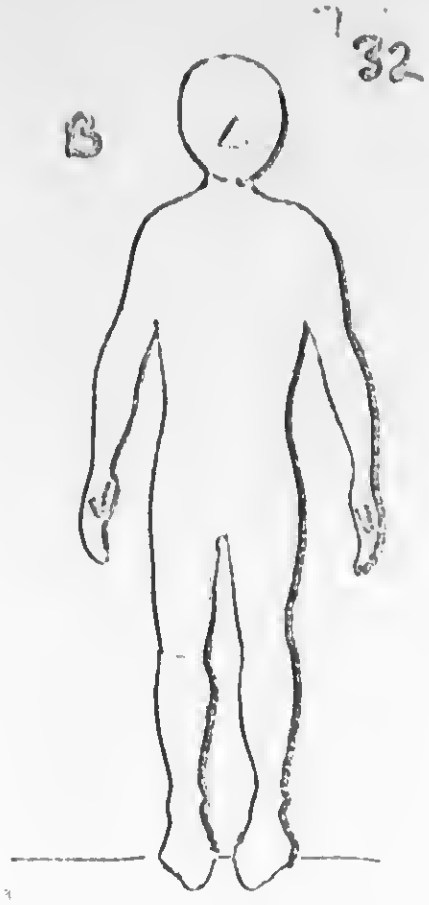
S. His toes, chest, arms, and I believe his nose and chin.

E. Is his whole arm on the floor?

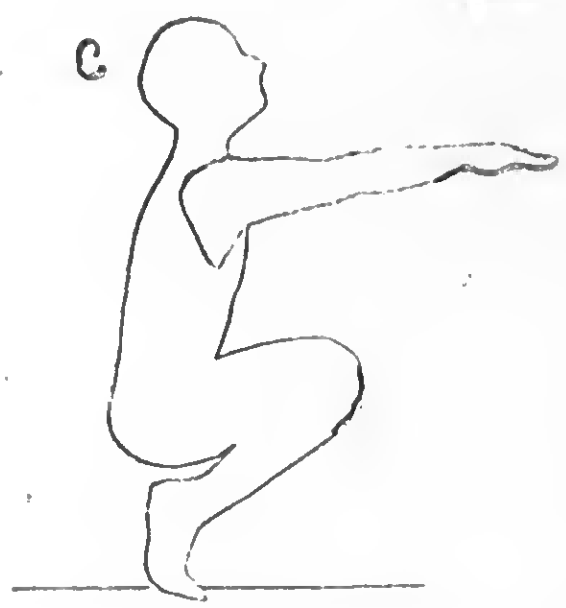
S. No, his arm is bent with his elbow in back of him. The next one is the same as the first one.

E. Okay, what do you think the stunt is?

S. Push-ups.



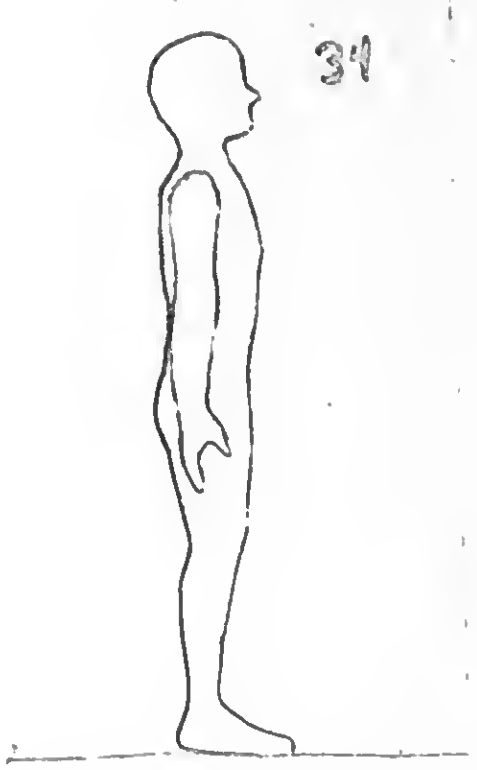
Drawing 32: Training



S. In the first one, he's squatting down with his arms in front of him, and it's his right side facing you. In the second one, he's standing erect with his arms down to his side facing you. In the third one, it's the same as before--as the first one.

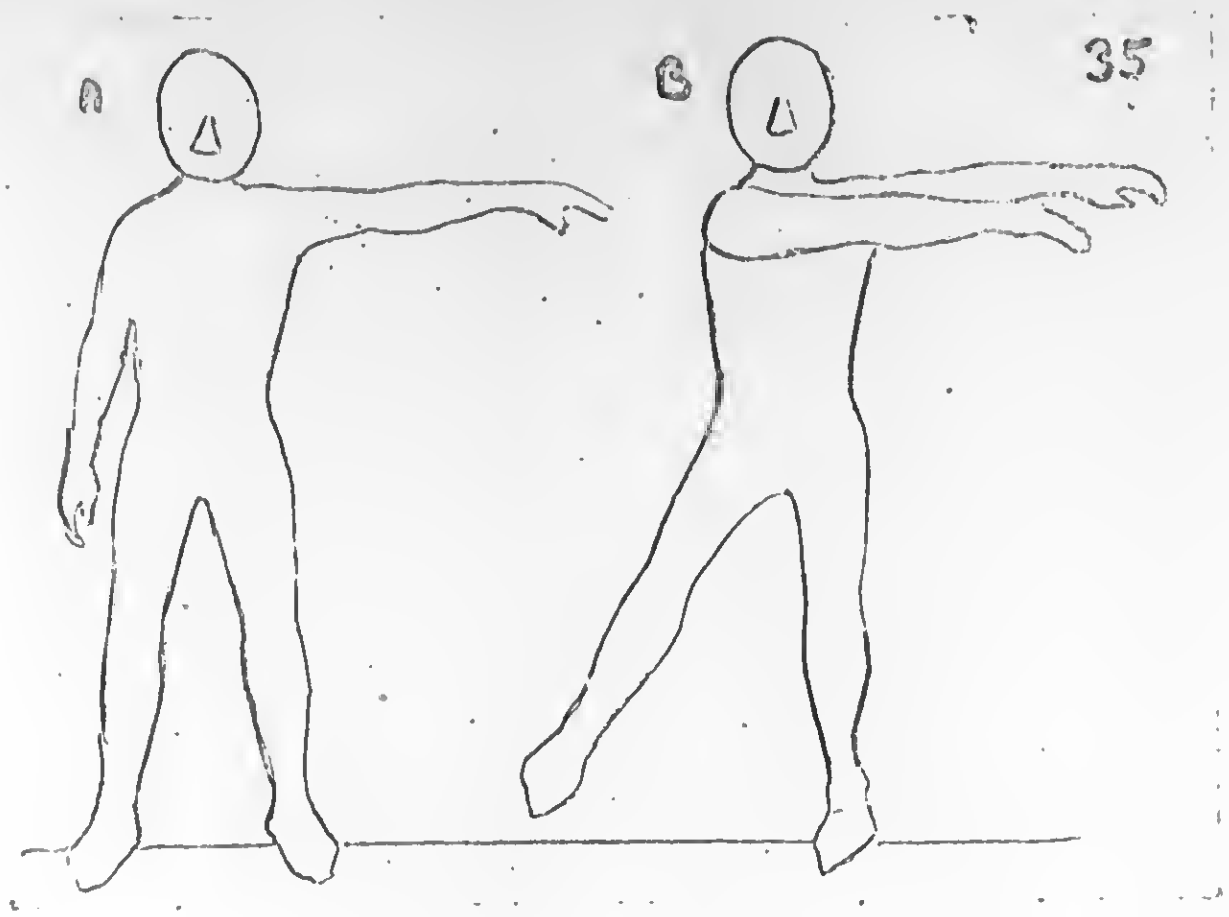
Drawing 33: Training

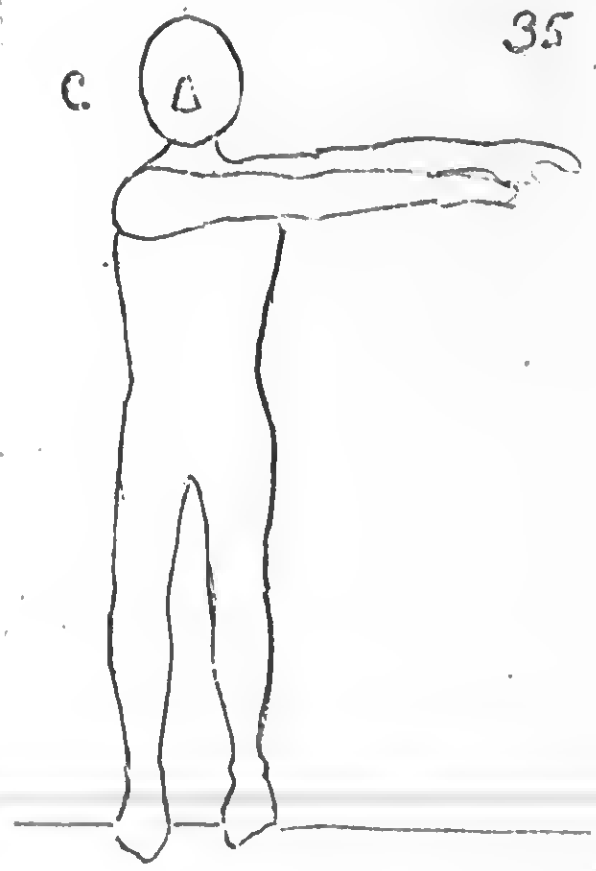
S. He's lying on his right side facing you with his right arm underneath his head, and his head is resting on his arm. His left arm is down to the side. His legs are straight and they're together.



Drawing 34: Training

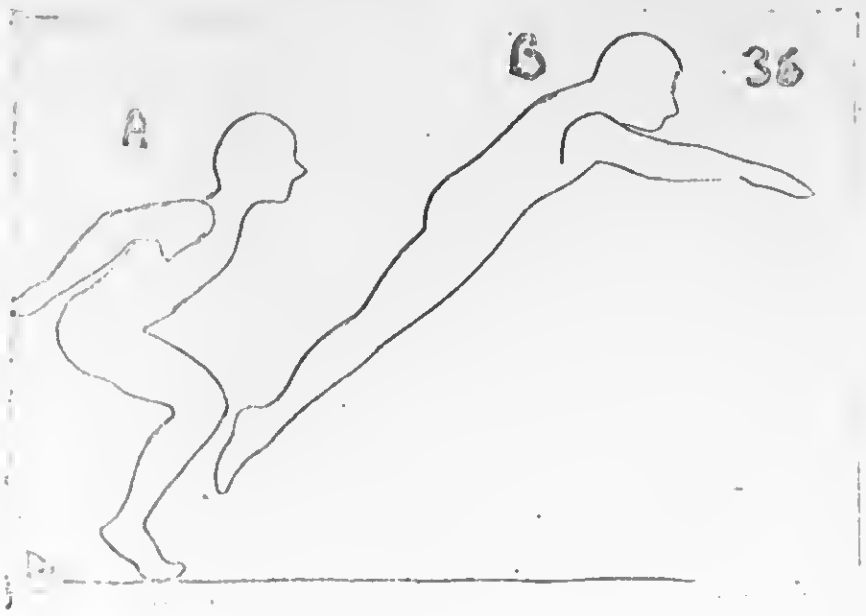
S. It's his right side facing you with his arms down to the side. His arms and legs are straight, and he's standing on the floor.

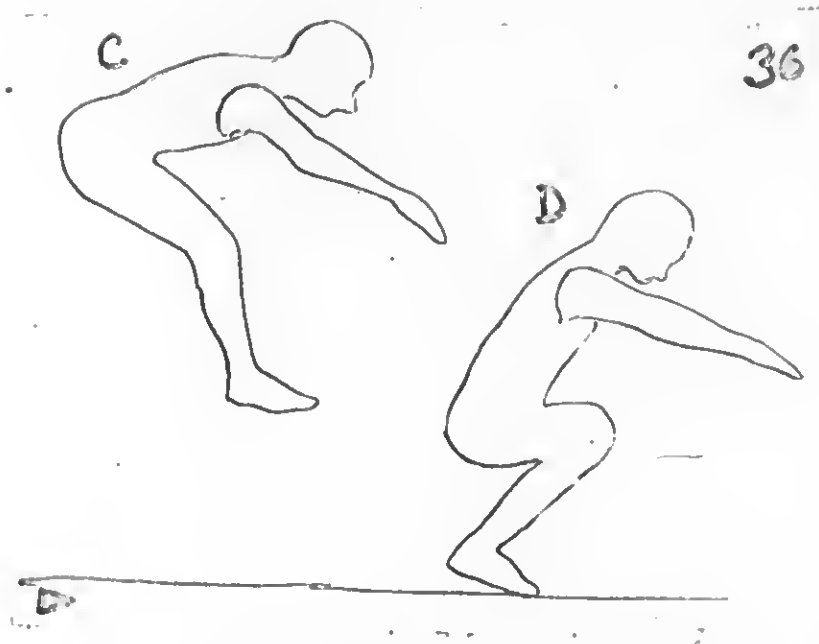




Drawing 35: Training

S. In the first one, he's facing you with his right arm down to the side and his left arm sticking out from his body. His feet are spread apart slightly, and his toes are pointing out. In the second one, his right foot is up off the floor, and his left foot's on the floor. His right arm is pointed out to the left in front of him--it's out in front of him pointing across his body, and his left arm is still sticking out from his body. In the third one, both feet are on the floor, and his arms are the way they were before.



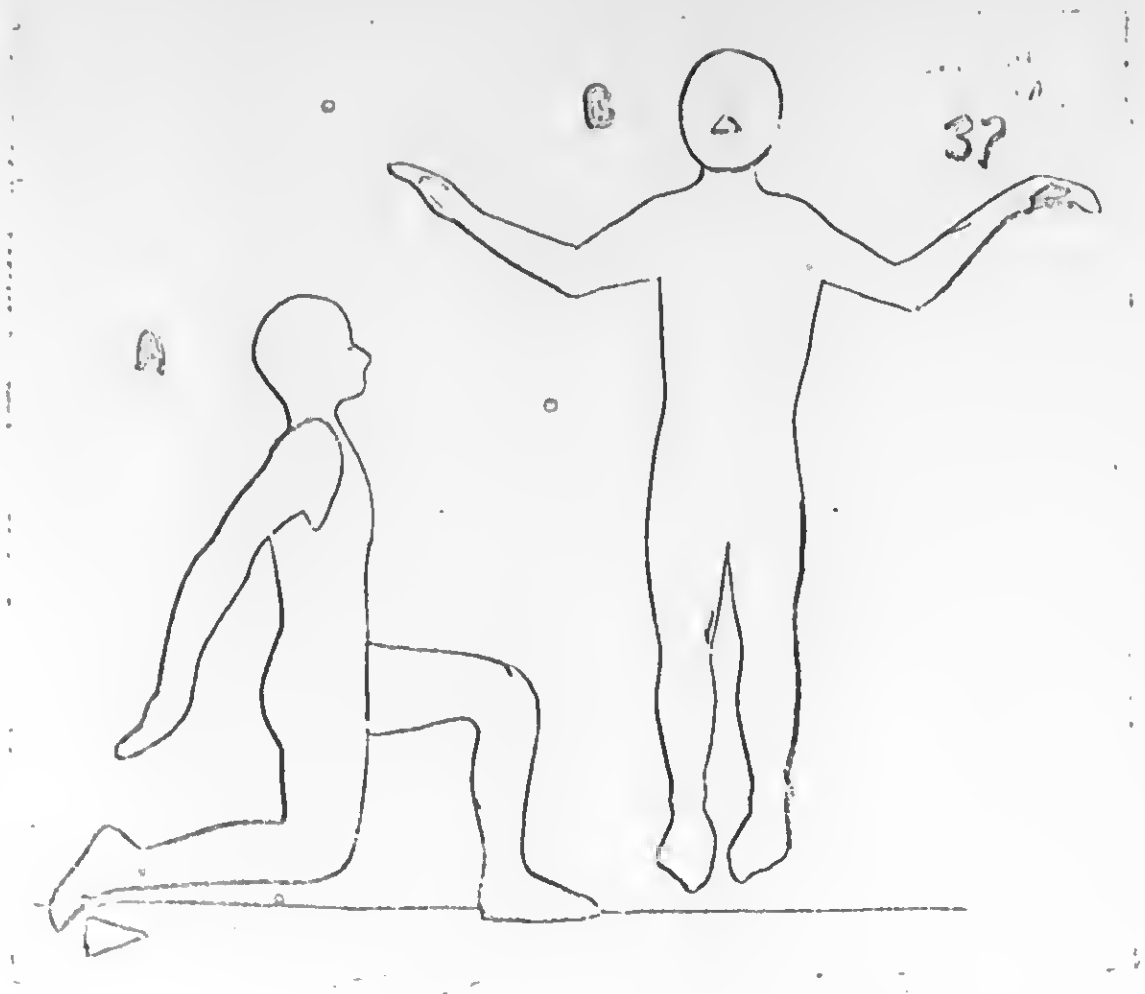


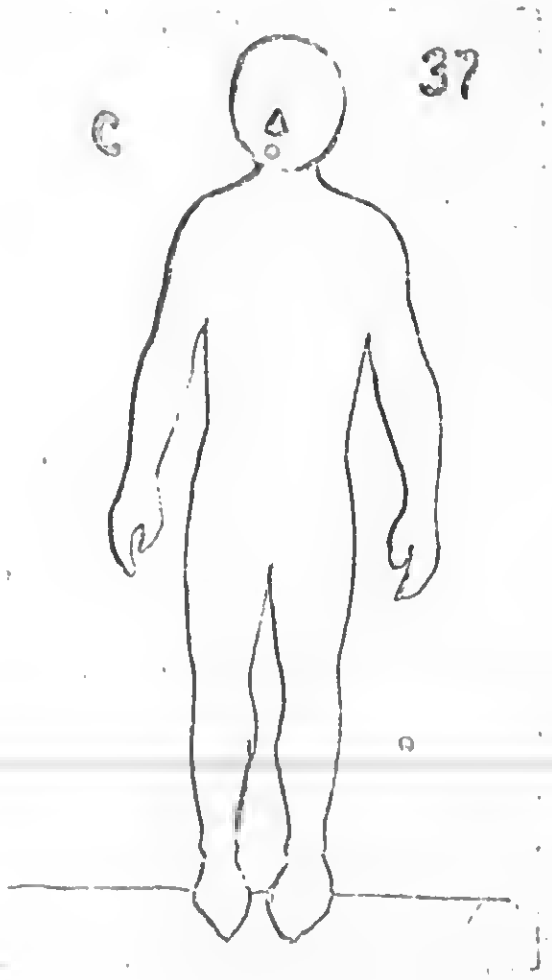
Drawing 36: Testing

S. Down here in the corner is the triangle. He's bent over slightly with his arms behind him, and his legs are bent, and he's resting on his toes. In the second one, his body is up off the floor, and his body is straight with his arms out in front of him. In the third one, it's like the position he was in before in the first one, only he's not touching the floor, and the fourth one is the same as the preceding one, only his toes are touching the floor.

E. What do you think he might be doing?

S. I would say leaping, kind of.





Drawing 37: Testing

S. In the first one, it's a side view with his arms behind him, and both legs are bent, and his left foot is on the floor. His right toes are just touching the floor.

E. How about his knee--his right knee? Is that on the floor?

S. It's slightly off the floor. Now he's facing us, and his arms are spread apart, and they're both slightly bent.

E. Palms down or palms up?

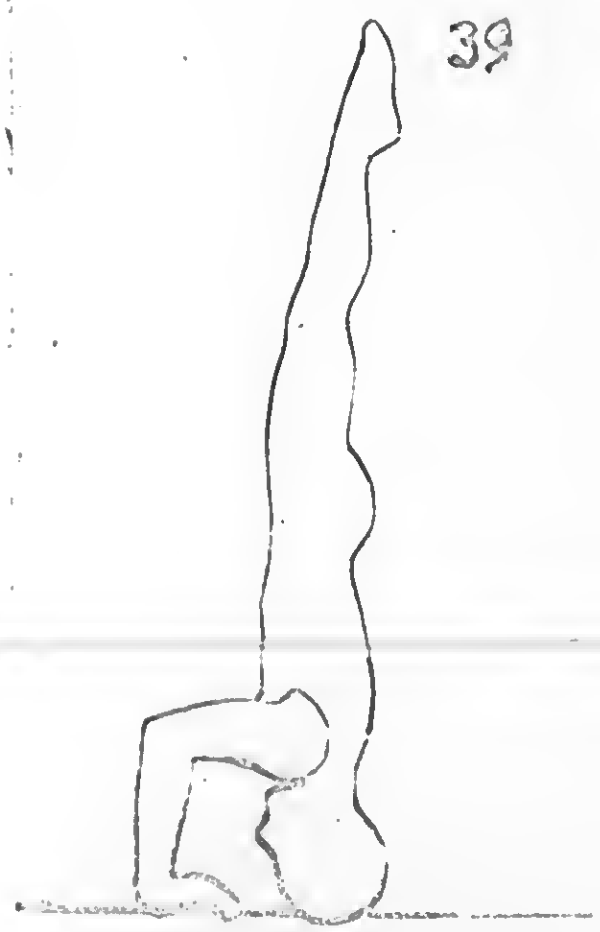
S. Palms down, with both feet off the floor. His legs are straight. In the next one, he's just standing erect with his arms down to his sides.

Drawing 38: Testing

S. He's facing you with his arms spread apart, and his body's slanting from the waist up, it seems. He's slanting, and his legs are straight.

E. Which arm is up and which arm is down?

S. His right arm is up in the air, and his left arm is pointing down toward the floor.

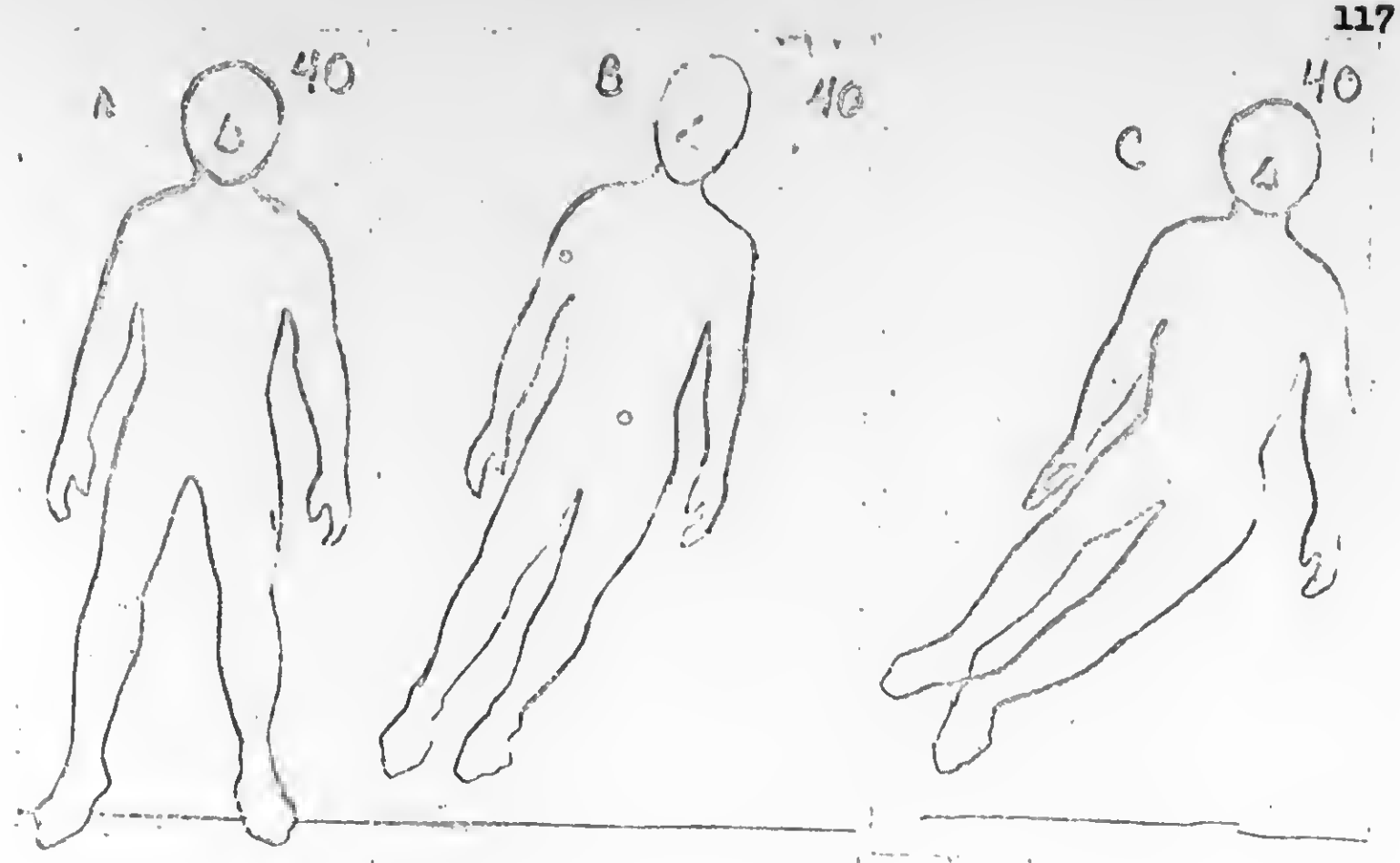


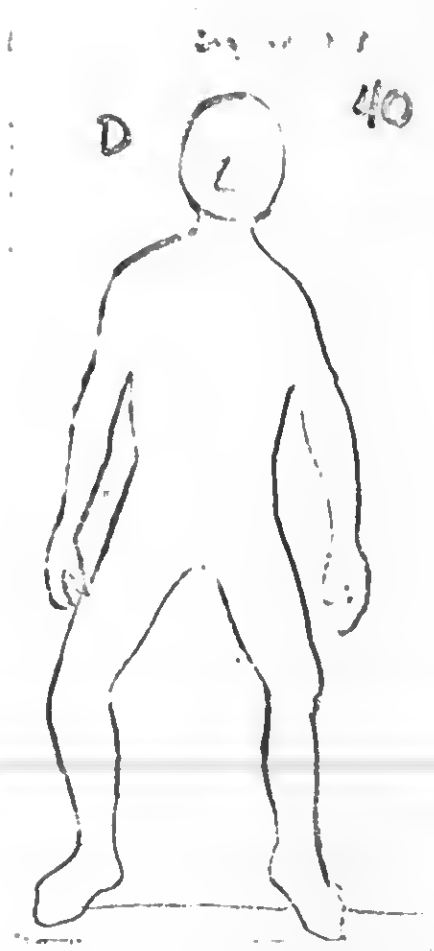
Drawing 39: Testing

S. Look's like he's standing on his head.

E. Where are his fingers pointing? In which direction?

S. Towards the head.





Drawing 40: Testing

5. In the first one, he's standing with his arms down to his side with both feet on the floor, and he's standing erect. The next one is the same as before, only his feet are off the ground, and he's slightly tilted to the left. In this third one, it is the same as before, only both heels are closer together in this one. In this fourth one, he's standing as he was before, only this time he's standing on his toes, and his legs are spread slightly apart, and I think his knees are bent a little bit more.

A P P E N D I X B

SUBJECT ERRORS ON DRAWINGS

The average score of the drawing is placed in parenthesis by or near the drawing number in the following discussion. The numbers of drawings do not run in consecutive order. They are grouped in fives with the first, third, fifth, and seventh groups of five having been used for training and the remainder of the 40 drawings having been used for testing.

Drawing 6 (6.36) was a static front view in stride standing position with arms extended straight from the shoulders. Points were deducted for subjects neglecting to state directions of the palms and for not stating differences which were found in the angles of the knees.

In Drawing 7 (6.08) the figure was lying on his back with his right arm to his side, thumb pointed upward. Many judgments show a failure to mention the angle of the hand and ankles, while a few confused the direction of the body, stating that it was on its side.

Judgments about Figure 8A (6.20) reflected confusion in terms of right and left identification of arms. Some had difficulty realizing that the left arm was on the side of the body and in describing the right arm as being under the head. Describing Figure 8B (6.35), subjects did not accurately state the angle of knees and elbows, some calling the straight limbs bent. There was some right-left confusion and a few did not offer a complete description. Judgments revealed that most missed the change in the angle of the left arm in Figure 8C (5.88). There was also some right-left confusion with Figure 8C.

Figure 9A (6.11) depicted a figure standing with his right leg flexed behind him while balanced on his left foot. The right arm was at his side. Judgments showed that subjects did not mention directions of palms, and there was some confusion in identifying right and left legs. The figure balancing on his head in 9B (6.11) had his hands and left foot on the floor with his right leg extended behind him. Most criticism was aimed at subjects not mentioning the direction of fingers, with some confusing right and left legs. A few judges noted that some subjects were unable to relate body parts on the baseline. Figure 9C (6.45) was the same as 9A except for a slight change in the angles of the right thigh which most subjects failed to note.

Figure 10A (6.40) was a figure sitting with his legs extended and his arms behind him, and the main problem appeared to be that of naming the direction of the fingers. A few expressed confusion over the relation of body parts to the baseline. In Figure 10B (5.85) points were deducted because of lack of a mention of finger direction, with some scores showing right-left difficulty. Figure 10C (6.68) was similar in the judges' estimation to Figure 10A.

Drawing 16, portraying a squat, was ranked at 6.12 because subjects did not note a backward tilt of the head.

Drawing 17 was a frontview sequence representing a side step involving various weight shifts and changes in angle of the legs. Figure A (6.25), B (6.12), C (6.48), D (6.50), and E (6.78), all had as their major deficiency direction of palms and toes. In

Figure B some subjects failed to see that the left leg had been raised higher than in Figure A. In that same figure some subjects did not state that the hand was closer to the thigh, while others mistakenly perceived that the hand was on the thigh. A few did not mention a weight shift of the body.

A leap was portrayed in Drawing 18A. Most students identified this as a run. The score of Figure A (5.97) was comparatively low because many subjects confused the right and left legs. Some, in an effort to show contrast between positions of right and left legs, stated that the right leg was in front of the figure when it was actually in line with his body. In addition to the confusion found in A, Figure B (6.06) had points deducted because subjects did not mention the direction of the right palm. Figure C (6.37) presented a similar problem.

Drawing 19 depicted a jump and half turn. Judgments showed that subjects did not mention direction of palms in Figure A (6.73). In Figure B (6.68) points were lost for the same reason, and in addition, a few subjects did not indicate that the toes were pointed. One subject failed to recognize the left side of the body in Figure C (6.77). Most points were subtracted in this figure due to the angle of the hand.

Drawing 20 (6.28) was a front static position with the figure balancing on his left leg and the heel of his hands resting on his hips. His right heel is against his lower left leg. Judges noticed many who stated that the right foot was on the left knee

while others remarked that the hands were on the hips without designating that only the heel of the hands was there.

A front sequence showing positional changes in arms which also entailed a shifting of body weight and a resulting tilt to either side from the waist was represented in Drawing 26. Subjects failed to mention the direction of hands in Figure A (6.75), and in Figures B (6.15) and C (6.65) the greatest difficulty was in noting a tilt of the head and waist. Figure D (6.85) presented the same problem as Figure A.

Drawing 27 involved the progression in a forward roll. Except for the score in Figure A, the scores belie the observation by the examiner that this was the most difficult sequence for subjects to grasp. Comments about Figure A (5.92) bear out that subjects had difficulty distinguishing feet from hands. Many could not relate to that figure at all, some being confused because they could not find the head which was hidden by the arms. Some defined the seat as the head, thereby confounding identification of other body parts. The elbow was, at times, called a knee. The majority became less confused by the time they had interpreted Figure B (6.17) and a few stated at this point that the figure was doing a somersault. The main problem with Figure C (6.05) was identifying the location of the right arm. Many stated that the hand was on the seat. The drawing itself is not entirely clear and it is understandable that identification was difficult. The problem with Figure D (6.65) was mainly that of not mentioning the direction of the palm or the slight backward tilt of the head.

Subject difficulty in Drawing 28 revolved mostly around varying angles of body lean. Figure A showed the figure bent from the hips at a 90° angle with arms extended beyond his head. Most faults with Figure A (6.32) were directed at a lack of mention of direction of hands and various descriptions of the body bend. Some subjects stated that the figure was bent at the seat while others said he was bent at the waist. This error may have been a result of misconceptions about the human body. Some points were deducted because subjects stated the arms as being over the head. Figure B showed a 5.93 score because subjects failed to notice a decided change in the hip angle. Figure C (6.12) indicated more attention to an additional change in the hip angle. Figure D (6.54) showed the figure facing front with arms extended over the head and this is the way many subjects stated it, without describing a difference in the amount of bend in the elbows. Two subjects stated that this looked like a blind man walking.

Drawing 29 (6.17) presented a front view of a figure lying on his right side propped on his elbow with his hand supporting his head. The left leg was raised in the air at a 45° angle from the baseline. Students showed a variety of faults. A few confused right and left hands, some were unable to identify the elbow as being on the baseline and a few misjudged the angle of the leg which was aerial.

The primary problem found in Drawing 30 (6.32), which depicted a V-sit, was that students failed to identify a backward tilt of the head. Some points were deducted for failure to identify the direction of the palm. A few knew the term V-sit but, since

there is a visual association with the letter "V", it held no meaning for them in terms of body position.

Drawing 36 represented progressions toward the standing broad jump. Figure A (6.34), was evaluated at that score because subjects did not mention the bend at the elbow or the direction of the palms. In Figure B (6.03) some subjects missed the forward tilt of the extended body. Subjects missed the forward tilt and angle of hips in Figure C (6.22). Two missed the body relation to the floor line. Main faults in Figure D (6.15) were the recognition of a decided hip and knee bend and the forward position of the head. This was a case in which subjects had a difficult time verbalizing about the angle of the body.

Figure 37A depicted a figure with the right knee almost on the floor and his weight on his left foot with his arm behind him. The average score on this drawing was 6.10 with the greatest problem being one of angles of joints, specifically of the waist, knee, and right toe. A couple of students mentioned that the figure was bent at the seat. Figure B (6.42) of this sequence showed the figure facing front in an aerial position with elbows bent and extended from the side of the body. Judges found that some missed the difference between right and left arms in the elbow bend and the variation in the angles of the hands. Figure C (6.81) had some mention of lack of description about direction of palms.

Drawing 39 (6.69), picturing a head stand, had as its primary criticism, a lack of mention or misconception about the direction of the fingers. Some subjects found it difficult to describe the angle of the elbow. Almost all subjects were able to identify the stunt.

Drawing 40 described progressions toward a heel-click and, as was mentioned in Chapter IV, major problems involved difficulty in describing differences in body angle. Figure A had a rating of 6.71 and subjects missed a slight shift of weight toward the left foot. Figure B (6.13) and C (6.13) presented even greater body angles which were not detected by subjects. In addition, Figure C represented a touching of the heels and some subjects missed that point. Figure D (6.03) showed the landing. Some subjects failed to mention that one hand was closer to the body than the other hand while others could not determine a difference in the amount of flexion of the right and left knees.

A P P E N D I X C

SCORESHEETS TO JUDGE FAULTS OF DRAWINGS

To the Judges:

When evaluating the position or sequences, consider the accuracy of the drawing in relation to its description. If the positions or movements do not express the description or, in some cases do not depict the specific skill, place a check in the column headed Fail. If they do accurately depict the position or skill, place a check in the column headed Pass. If the drawing receives a fail, please comment in the "Reason if Fail" column.

On all sequential drawings in which there is movement from one place to another, a triangle has been placed on the lower left corner of the page.

The movements or positions have been divided into five classifications; Static Front, Static Side, Sequential Front, Sequential Side, and Sequential Combination. Drawings are labeled to correspond with your score sheet. Any suggestions will be greatly appreciated and considered.

SCORE SHEET JUDGE_____

Drawing & Number	Description	Pass	Fail	Reason if Fail
	STATIC FRONT			
1.	Stand, foot apart, arms straight down at sides			
2.	Stand legs apart, knees bent, arms extended to sides at shoulder level			
3.	Stand on left leg, other foot on left leg, hands on hips			
4.	Sit on right hip, right hand on floor, other on leg, legs extended and together			
5.	Stand, foot apart, lean to left, arms overhead			
6.	Lie on right side, left arm along legs and straight, right arm overhead, head resting on arm, legs extended and together			
7.	Lie on right side, right hand supporting head, right elbow on floor, left leg at 90° to body, right leg extended on floor, left arm alongside body			
8.	Stand, lean to left side, left arm down, right arm up, both extended straight from shoulder. Feet close together			
	STATIC SIDE			
1.	Lying prone, legs extended, instep just off floor, chin on floor, arms along side, extended, palms down			
2.	Lying supine, legs extended, arms at side			
3.	Kneel, both knees, arms extended in front of body			
4.	Sit, legs extended, hands on knees			
5.	Squat on toes, arms extended in front of body			
6.	V-sit, head tilted slightly back			
7.	Stand, arms at side			
8.	Head stand			

Drawing & Number	Description	Pass	Fail	Reason if Fail
	SEQUENTIAL FRONT			
1.	Stand right foot against left leg, hands on hips, stand			
2.	Lie on right side, right arm on floor, hand on arm, left arm on side. Same, but left arm raised to 90°. Same, but left leg raised, toe pointed out			
3.	Stand, weight on left foot arms straight down at sides. Same but cross right leg over left. Weight on right foot, left toe on floor. Stand			
4.	Stand, arms at side. Jump, toes extended off floor. Land			
5.	Stand, feet apart, left arm extended straight to side from shoulder. Right arm across body, right foot raised. Weight on both feet, both arms extended across body to left at shoulder level			
6.	Stand, left foot away from body. Left foot further from body. Step, weight on left foot. Raise left foot from floor, weight on right. Weight on both feet			
7.	Stand, arms straight down at side. Raise both arms and then raise right arm at lower left, both straight from shoulders. Raise left arm, lower right straight from shoulder. Stand. Arms down at sides			
8.	Stand, feet apart. Jump, feet to right. Touch heels in air. Land, knees bent, feet apart			
	SEQUENTIAL SIDE			
1.	Stand, arms down at side. Bend at waist, arms stretched overhead to reach for toes keeping knees straight			
2.	Stand on left foot, right knee bent and back, lift right foot back, touch hands and head to floor, still on left foot. Stand on left foot, arms to sides			

Drawing & Number	Description	Pass	Fail	Reason if Fail
SEQUENTIAL SIDE (continued)				
3.	Walk: step right foot ahead of left with left arm swinging forward, left foot steps ahead, arms in opposition, right foot ahead, arms in opposition			
4.	Leap: weight on toe of right foot, left knee bent with food back of body, legs extended, left foot in front right. Land on left foot with right knee bent and foot back			
5.	Stand, arms down at sides; extend arms, right foot ahead of left, right heel on floor, left toe on floor, arms same, left heel on floor, right toe on floor (step)			
6.	Forward roll: head and arms and right toe on floor, left leg bent and extended back, weight on hands and head, body inverted, hips bent, both legs back and together on back, hands at side, legs over body. Sit, hands on knees			
7.	Push-up: hands and toes on floor, legs, body and arms straight. Elbows bent, hands, chest, feet and chin on floor, body close to floor. Same as first position			
8.	Standing broad jump: toes on floor, legs bent (knee-hips), arms back. Arms and legs extended, body at angle to floor and thrust forward. Body bent at waist and knees, head, arms and feet forward, body in air. Body bent at hips and knees, arms extended behind body, feet on floor			
SEQUENTIAL COMBINATION				
1.	Half turn: standing, side, right arm straight along side of body. Body front, arms by sides, toes extended and off floor, legs and arms straight, standing, same as first part but in opposite direction			

Drawing & Number	Description	Pass	Fail	Reason if Fail
	SEQUENTIAL COMBINATION (continued)			
2.	Sitting tall, hands on floor behind body, legs extended and on floor. Twist and raise to support weight on right hand and right foot as left arm at 90° to body. Body, legs and arms straight. Same as first part			
3.	Standing on left foot, right foot lifted straight forward from body, arms stretched in front of body. Face front, both feet on floor, legs and arms down straight, arms by sides. Same as first part but left leg extended with weight on right foot			
4.	Leap and ¼ turn: right heel on floor, right leg in front of left. Left knee bent with left foot back with right arm. Left arm forward, spring to stretch left leg straight forward. Legs extended off floor, left in front of right, left arm extended in front of body and right arm bent behind body. In air, right leg bent and back, left bent in front, arms in opposition, land with knees bent, arms by side			
5.	Stand arms straight down by sides, bend knees, lean body back, arms extended forward at shoulder level. Turn to face front, foot close together on floor, raise arms over head, elbows bent			
6.	Body bent at waist, arms stretched over-head, legs straight. Step forward with right heel on floor, left toe in back of right foot and on floor. Same but left foot forward. Face front raising arms bent at elbows to overhead, weight on both feet, feet close together to end in standing tall position			

Drawing & Number	Description	Pass	Fail	Reason if Fail
	SEQUENTIAL COMBINATION (Continued)			
7.	Squat, arms straight and extended forward from shoulders. Weight on toes, turn to face forward, arms down at side, feet on floor and close together. Same as first position			
8.	Left foot and right toe on floor, arms behind body, both knees bent, almost to kneel on left knee, right foot behind left. Face front jumping off floor, arms bent and palms down, extended out from shoulder, legs close together. Land, arms at side of body, foot close together			

A P P E N D I X D

PERMISSION SLIP AND COVER LETTER TO PARENTS OF BLIND SUBJECTS

December 29, 1966

Dear Parent:

Miss Jane Heidorn, a candidate for a doctorate at Ohio State University, wishes to do research at the Ohio State School for the Blind. This research includes working with some of our fifth, seventh, and eighth grade students.

Miss Heidorn will attempt to determine the extent to which raised drawings can be utilized in teaching movement skills. Our pupils will be taught to read movement sequences from raised drawings then asked to perform and interpret these.

Video tapes will be made of each pupils performance. These tapes will be evaluated by teachers at Ohio State University. The names of the pupils will be coded--their real names will not be used.

Miss Heidorn and I will appreciate having you sign the attached permission form and returning it to us in the stamped envelope.

Sincerely yours,

D. W. Overbeay
Superintendent

- -

PERMISSION FORM

I give my consent to Miss Jane Heidorn to use _____
(Name of Pupil)

as a subject in her research project for a Ph.D. degree. I do so with the understanding that no real names will be used.

Signed _____

A P P E N D I X E

INSTRUCTIONS TO JUDGES AND SCORE SHEETS USED TO JUDGE SUBJECTS

INSTRUCTIONS FOR JUDGES

GENERAL

1. Attempt to use the following schedule, completing no more than one session in any one day.

1st session:	Subjects 2, 3, 4, 5; 1 hour, 55 minutes tape time
2nd session:	Subjects 6, 7, 8, 9; 1 hour, 56 minutes tape time
3rd session:	Subjects 10, 11, 12; 1 hour, 35 minutes tape time
4th session:	Subjects 13, 14, 15; 2 hours, 7 minutes tape time
5th session:	Subjects 16, 17, 18, 19; 1 hour, 58 minutes tape time
6th session:	Subjects 20, 21, 22, 23; 1 hour, 58 minutes tape time

2. You may allow time between subjects, but if possible finish each subject at one sitting.

3. If possible, finish judging in two weeks (one week would be better).

4. Keep judging sessions as conducive to good concentration as possible.

5. If you do not understand a subject's response, you may rewind the tape and listen to the response again.

6. Judge subjects in their numerical order.

7. After judging each subject, place the score sheet in the manilla folder provided. Do not refer back to previous score sheets.

SCORING

1. The score limits range from one to seven, with a seven being the best possible score.

2. State your reason for a score below seven, using the coded symbols provided on the score sheet.

3. Your rating will be subjective. Consider the importance of an error in relation to the total concept the subject seems to convey about the figure.

4. Just prior to and/or during the subject's description, view the drawing(s) and compare his description to that drawing.

5. All subjects are tested according to the numbers on the score sheet except subject number 2. The drawing order in this case is identical, but the numbers used are those <u>not</u> circled on the Brailon sheets.

6. Except in the above case, the number on the score sheet and the circled number on the Brailon sheet are announced prior to the subject's recitation. The letters by the numbers correspond with each figure on the Brailon sheet. The letters are not indicated on tape. Usually the words "next" or "O.K." are used to indicate progression to the next figure.

7. A separate rating should be given for each figure.

8. On drawing number 8, Figures B and C were inadvertantly presented out of order on tapes 2, 3, and 4. This error will be easily recognized when the subject responds. Score according to the subject's description of the figure.

9. Certain points are offered by or elicited from subjects. These are listed on the score sheet. Only those questions were asked which seemed important for a clear description of a specific figure. If it was obvious that a subject understood a point at the beginning of the testing, e.g., arm straight vs. bent, he was not asked to repeat it on subsequent figures. He might just say, "Arms are by the side and the person is standing." This was considered an acceptable description.

10. All subjects easily identified the triangle where indicated, and all understood its meaning (movement from one place in space to another place in space). In order to save tape time, the question was not pressed.

SUBJECT NAME_____ SUBJECT NUMBER_____ JUDGE_____

SCORE SHEET

Drawing Number	Score	Reason, if below seven
6		
7		
8(A)		
(B)		
(C)		
9(A)		
(B)		
(C)		
10(A)		
(B)		
(C)		
16		
17(A)		
(B)		
(C)		
(D)		
18(A)		
(B)		
(C)		
19(A)		
(B)		
(C)		
20		
26(A)		
(B)		
(C)		
(D)		
27(A)		
(B)		
(C)		
(D)		
28(A)		
(B)		
(C)		
(D)		
29		
30		
36(A)		
(B)		
(C)		
37(A)		
(B)		
(C)		
38		
39		
40(A)		
(B)		
(C)		
(D)		

Directions for Judges

SCORE THE SUBJECT'S RESPONSE ON EACH FIGURE

SCORES MAY RANGE FROM ONE TO SEVEN. A ONE INDICATES A VERY POOR PERFORMANCE, AND A SEVEN INDICATES EXCELLENT PERFORMANCE

IF YOU SHOULD SCORE A RESPONSE BELOW SEVEN, STATE THE REASON, USING THE CODED LETTERS SUGGESTED BELOW. ALSO STATE OTHER REASONS NOT INCLUDED BELOW

THE FOLLOWING ARE CATEGORIES THAT THE SUBJECTS REFERRED TO IN THEIR DESCRIPTIONS. USING THE LETTERS WHICH SYMBOLIZE THESE CATEGORIES, IDENTIFY SUBJECT ERRORS

GB GROSS BODY POSITION

DB DIRECTION OF BODY: SIDE OR FRONT

AB ANGLE OF BODY: FORWARD OR BACKWARD

RB RELATION OF BODY OR BODY PARTS TO THE FLOORLINE

RL RELATION OF LIMBS, HANDS, & FEET TO EACH OTHER

HF IDENTIFICATION OF RIGHT AND LEFT HANDS OR FEET

BP IDENTIFICATION OF BODY PARTS

AJ ANGLES OF BODY JOINTS

C STATEMENT CORRECTED AFTER FURTHER SCRUTINY BY SUBJECT OR AFTER QUESTIONING BY EXAMINER

OTHER: PLEASE DESCRIBE

A P P E N D I X F

LETTER REGARDING DRAWINGS

SAN FRANCISCO STATE COLLEGE

Please reply to:
Berthold Lowenfeld, Ph.D.
2928 Avalon Avenue
Berkeley, Calif. 94705

March 17, 1966

Miss Jane Heidorn
2228 N. High Street
Apartment 27
Columbus, Ohio 43201

Dear Miss Heidorn:

This is a belated reply to your letter of January 26. I was away from my office a good deal and swamped with other work of immediate urgency.

First, let me thank you for your kind words about my book, "Our Blind Children." Of course, I can well understand that working with the blind does interest you and appears to evoke your enthusiasm.

However, so far as your project is concerned of teaching movements to blind students by giving them figure drawings in embossed forms, I am afraid I cannot be encouraging. I do not believe that anything of this kind would assist blind children in learning body movements. They have no difficulties in learning these movements by observations and some verbal explanation. Drawings in essentially two-dimensional form will only be confusing to them, I am sure. We have always had attempts by well-meaning adults to supply embossed drawings of all forms of things, including the human body. For a short while, a blind child's interest may be captured by them--largely because of the personal attention he gets from the person who must explain it to him, but beyond this interest which has little to do with the drawing itself, no gains resulted. For this reason, I cannot recommend that you spend more time on the exploration of the attempts you described in your letter. The February 1966 issue of the New Outlook for the Blind has a very good article, "Self-Realization--But Not Through Painting," by Charlotte Haupt (pp. 43-46). It deals with a similar well-meaning but ill-conceived attempt.

With best wishes,

Sincerely yours,

Berthold Lowenfeld
Research Professor
Frederic Burk Foundation
for Education

BL:fw

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